C E R E A L S

WHOLE PROCESSED

ENRICHED

Nutrition Programs Branch

December 15, 1943

MEMORANDUM

To: Miss Jessie W. Harris, Chief, Nutrition Division

From: Nora M. Kefauver, Assistant Home Economist, Nutrition Division

Subject: Report on Cereals--Whole, Processed, Enriched

According to the request of, and with the supervision of, Miss Mabel R. Stimpson, Nutritionist, the following report has been made.

Data have been collected on the flour and bread enrichment activities of recent date. Source material included texts, reviews, journals, and government, state, and commercial publications. By combining material from several references, tables of comparative values have been set up.

Herein are copies of the tables and of pertinent information which has been recorded in such a way that queries of practical nature may be quickly answered with documentation.

cc: Miss Mabel R. Stimpson
Dr. Robert S. Goodhart

Nutrition Programs Branch

December 15, 1943

MEMORANDUM

To: Miss Jessie M. Harris, Chief, Nutrition Division

From: Nora M. Kelsaver, Assistant Home Economist, Nutrition Division

Subject: Report on Cereals—Whole, Processed, Enriched

According to the request of, and with the supervision of, Miss Mabel K. Simpson, Nutrition Lab, the following report has been made.

Data have been collected on the grain and breakfast enrichment activities of recent date. Source material included texts, reviews, journals, [illegible] government, state, and commercial publications. By combining material from several references, tables of comparative values have been set up.

Herein are copies of the tables, as of pertinent information which has been recorded in such. Any text material of practical nature may be usually answered with communication.

cc: Miss Mabel K. Simpson
Dr. Robert S. Goodhart

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WHOLE PROCESSED

ENRICHED

Food Distribution Administration
Nutrition Programs Branch
Washington, D. C.

Food Distribution Administration
Nutrition Programs Branch
Washington, D. C.

CEREALS: Whole, Processed, Enriched

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Nora Kefauver
Dec. 15, 1943

CEREALS: Whole, Processed, Enriched

PLACE IN DIET:

Nutrition Reviews, Nutrition Foundation, Inc., Chrysler Bldg., N.Y.C., June 1943, 8 page 238: "In a recent study, Willard (Am. J. Publ. Health, 32, 996 (1942) found that a dietary survey of 1169 school children in Worchester County, Maryland, "more than confirmed the impression of poor dietary habits and existence of a nutritional problem". Information was collected concerning the intake of 5 principal groups of foods: milk, vegetables (except potatoes), fruit, cereal or whole grain, and meat. It was revealed that only 41 percent of the children received 2 or more cups of milk per day. In the opinion of the author, only 19 percent consumed adequate vegetables, 20 percent sufficient fruit, and 41 percent adequate cereal or whole grain. In contrast, 97 percent of the children were thought to receive sufficient meat."

Sherman, H. C., and Constance S. Pearson, Modern Bread, The MacMillan Co., 1942, (389.1 Sh5M), page 14: "Typical estimates from summaries in other Government publications and by Cummings (1940) show 19 per cent of the food calories furnished by breadstuffs in the dietaries of professional men's families, 27 percent in well-to-do farm families, 39 percent in workingmen's families, 54 percent in poor southern farm families."

CEREALS: Whole, Processed, Enriched

MILK IN DIET:

Nutrition Review, Nutrition Foundation, Inc., Chrysler Bldg., N.Y.C., June 1943, 8 page 232: "In a recent study, Willard (Am. J. Publ. Health, 32, 906 (1942) found that a dietary survey of 1187 school children in Worcester County, Maryland, "more than confirmed the impression of poor dietary habits and existence of a nutritional problem". Information collected concerning the intake of 5 principal groups of foods: milk, vegetables (except potatoes), fruit, cereal or whole grain, and meat. It was revealed that only 41 percent of the children received 2 or more cups of milk per day. In the opinion of the author, only 19 percent consumed adequate vegetables, 20 percent sufficient fruit, and 41 percent adequate cereal or whole grain. In contrast, 97 percent of the children were thought to receive sufficient meat."

Sherman, H. C., and Constance A. Lanson, Modern Food, The MacMillan Co., 1942, (380.1 S45M), p. 4: "Typical estimates from summaries in other Government publications and by Gunnings (1940) show 19 per cent of the food calories furnished by breadstuffs in the diet-aries of professional men's families, 27 percent in well-to-do farm families, 29 percent in workingmen's families, 34 percent in poor southern farm families."

CEREALS: Whole, Processed, Enriched

COMPOSITION OF:

Cooper, Barber, and Mitchell, Nutrition in Health and Disease, J. B. Lippincott, Philadelphia, 1941, page 439: "The cereals are the hard kernels or seed-like fruits of certain plants of the grass family."

"Yellow corn meal ranks first for Vit. A content, while wheat and oats are rich in the vit.B.complex. The general composition of cereals is as follows:

Water	.10 to 12	Percent
Proteins	.10 to 12	"
Carbohydrates .	.65 to 75	"
Fat	1 to 8	"
Mineral matter .	1 to 2	"

The seed kernel of the grain plant is composed of three parts: germ endosperm, and bran coat or husk. The endosperm makes up about 85 percent of the wheat, as it contains all the material stored for use by the developing grain. The food is stored mainly in such forms as starch grains and gluten granules. The husk or bran is largely cellulose plus a large part of the mineral and vitamin B complex of the grain. The germ is the tiny portion which sprouts when the seed is planted and is the portion which spoils first in whole grain products. Wheat germ practically free from bran is now on the market and serves as a palatable cereal supplement high in vitamin B complex and vitamin E. Several cereals are now fortified with extra wheat germ or other source of the B vitamins. The keeping quality of wheat germ or products containing it has been improved by some method of sterilization."

(TABLE: Whole, Processed, Mutilated

COMPOSITION %:

Cooper, Wilson, and Kimball, Nutrition in Health and Disease, J. B. Lippincott, Philadelphia, 1941, page 129: "The cereals are the best begrain or seed-like fruits of certain plants of the grass family."

Allow some meal weighs first for 4%, & cornbrnb, while wheat and rye are much in the vit.complex. The general composition of cereals is as follows:

Water	10 to 12 Percent
Proteins	10 to 16 "
Carbohydrates . .	65 to 75 "
Fat	1 to 2 "
Mineral matter . .	1 to 2 "

The cereal kernel or the grain which is composed of three parts: germ endosperm, and bran coat or hulls. The endosperm makes up about 85 percent of the whole, or it contains all the material stored for use by the developing germ. The food is stored mainly in starch form as well as small amounts of protein. The hull or bran is largely cellulose with a large part of the mineral and vitamin B complex of the grain. The germ is the living portion which the seed is planted and is the portion which sends first to whole grain product. Germ may be specifically free from bran if from the germ and serve in a relatively small amount which is vitamin B complex and minerals. Germ meals are now being with extra wheat germ or other grains or as a vitamins. The vitamin quality of wheat germ meal is considerable so one can increase by some method of concentration.

CEREALS: Whole, Processed, Enriched

FUNCTIONS OF ELEMENTS IN:

Sherman, H. C. Chemistry of Food and Nutrition, MacMillan Co., N.Y.C., 1941, page 378: "For the purposes of this book, it seems sufficient to call attention to the fact that the findings of several investigators show that compounds (we do not yet know how many) of thiamine, of riboflavin, and of nicotinic acid all function in the complex enzyme-coenzyme systems which catalyze the oxidation process in the body tissues, and that there may be interrelations in their action."

GERMAIN: Whole, Processed, Enriched

FURTHER OF ELEMENTS IN:

Sherman, H. C. Chemistry of Food and Nutrition, Macmillan Co., N.Y.C., 1941, page 378: "For the purposes of this book, it seems sufficient to call attention to the fact that the findings of several investigators show that compounds (we do not yet know how many) of this type, of vitamin, and of microbic acid all function in the complex enzyme-coenzyme systems which catalyze the oxidation processes in the body tissues, and that there may be interrelations in their action."

CEREALS: Whole, Processed, Enriched

THIAMIN, Effect of Deficiency on Human Nutrition:

Parran, Dr. Thomas, "Nutrition and Public Health", The Food Front, F.S.A. 1942, (173.3 H34F), page 13; "Dr. Wilder, in Mayo Clinic, has carried on a number of studies in recent years designed to show the role of thiamin in human nutrition. He took three groups of patients, one on an optimum diet, one on an average diet, and the third on a diet deficient in thiamin - that is, vitamin B_1. It was perfectly clear from those experiments that where thiamin was deficient physical vigor went down, total capacity for work went down, and more of the third group of patients developed phobias and apprehensions concerning situations about which they could do nothing. In other words, there was a lack of morale. It over-simplifies the problem to say that this is a morale weapon, but it is certain that this vitamin has much to do with the metabolism of brain and nerve tissue of the whole nervous system. Lack of it does produce serious effects.

"In a second series of experiments, Dr. Wilder was interested in determining the degree of efficiency among these patients. He found the third group inefficient. In doing household tasks they were clumsy - they dropped the dishes and broke them. Others who were skilled with their needles became clumsy and couldn't do crocheting or knitting with anything like their former speed or accuracy."

Annual Review of Biochemistry, Stanford University, 1943, (381 An7), page 322:

"Thiamin deficiency was found to decrease physical endurance, as measured by tests involving holding out the extended arm and holding the breath, and its administration greatly increased the endurance." From: McCormick, W. J., Medical Record, 152, 439-42 (1940).

Nutrition Reviews, The Nutr. Foundations, Inc., Chrysler Bldg., N. Y. C., May 1943, 7, page 210: "The question in point is whether thiamine deprivation is responsible for nerve degeneration. There is no question that acute thiamine deficiency produces neuropathologic disturbances and that crystalline thiamine administration alleviates these symptons in a short time."

Nutrition Reviews, The Nutrition Foundation, Inc., Chrysler Bldg., N.Y.C., November 1942, 1, page 29: "Thiamin deficiency in man may manifest itself in a variety of ways, e.g., anorexia and neurasthenic symptoms, multiple neuropathy, central neuropathy (Wernick's Syndrome), and Cardiovascular dysfunctions. It is almost invariably associated with other nutritional deficiencies or organic or psychological abnormalities which complicate the picture and make the diagnosis difficult." from: Swank and Prados (Arch. Neurol. Psychiat. 47, 97 (1942)).

Journal of the American Dietetic Association, April, 1942 (Vol. 18, No.4), "Why Enriched Bread?", by Williams and Wilder: "The vitamins, thiamin, and niacin, are needed to assimilate a starchy food-like bread. Without them, poisonour products are formed within the body by incomplete combustion of this food."

CHAPTER 2: Whole, Processed, Enriched

THIAMIN, effect of deficiency on human nutrition:

Barron, Dr. Thomas, "Nutrition and Public Health", The Food Trade, F.D.A., 1942, (pp.3 [illegible]), page 13: "Dr. Miller, in Cleveland, has carried on a number of studies in recent years designed to show the role of thiamin in human nutrition. He took three groups of patients, one on an optimum diet, one on an average diet, and the third on a diet deficient in thiamin - that is, vitamin B_1. It was perfectly clear from those experiments that where thiamin was deficient physical vigor went down, total capacity for work went down, and more of the third group of patients developed phobias and apprehensions concerning situations about which they could do nothing. In other words, there was a lack of morale. It over-simplifies the problem to say that this is a morale vitamin, but it is certain that this vitamin has much to do with the metabolism of brain and nerve tissue of the whole nervous system. Lack of it does produce serious effects.

"In a second series of experiments, Dr. Miller was interested in determining the degree of efficiency among these patients. He found the third group inefficient. In doing household tasks they were clumsy - they dropped the dishes and broke them. Others who were entrusted with their needles became clumsy and couldn't do crocheting or knitting with anything like their former speed or accuracy."

Annual Review of Biochemistry, Stanford University, 1943, (391 Ann), page 200:

"Thiamin deficiency was found to decrease physical endurance, as measured by tests involving holding out the extended arm and holding the breath, and the administration greatly increased the endurance."

From: Underhill, F. A., Medical Record, 126, 429-40 (1929).

Nutrition Review, The Nutr. Foundation, Inc., Cleveland Ohio, N. Y. C., May 1943, p. 2, page 210: "The question in point is whether thiamine deficiency is responsible for nerve degeneration. There is no question that some thiamine deficiency produces neuropathologic disturbances and that supplying thiamine administration alleviates these symptoms in a short time."

Nutrition Review, The Nutrition Foundation, Inc., Cleveland Ohio, N.Y.C., November 1942, 1, page 326: "Thiamin deficiency in man may manifest itself in a variety of ways, e.g., anorexia and nonspecific symptoms suggestive neurasthenia, general nervousness (irritability, tension), and difficulties in concentration. It is almost invariably associated with other nutritional deficiencies or presents an psychological abnormalities which cloud considerable the picture and make the diagnosis difficult."

From: Lamb and Jones (Amer. Journ. Psychiat. 97, 67 (1940)).

Journal of the American Dietetic Association, 1941, 17(6) (pp. 10, No.4), "Dry Enriched Bread", by Williams and Mitchell: "The vitamins, thiamin, and niacin, are needed to maintain a healthy food-like bread. Without them, problems arise. Yeast is formed within the body by bacteria assimilation of this food."

CEREALS: Whole, Processed, Enriched

THIAMIN In:

Nutrition Reviews, The Nutrition Foundation, Inc., Chrysler Building, N.Y.C., January 1943, 3, page 73: "White flour of a hundred years ago was probably an excellent source of thiamine." "It was concluded that the best white flours of a century ago must have contained concentrations of thiamine comparable to those of the whole grains from which they were made. In a footnote, the authors state that further work has shown that stone milled flours are also proportionately richer in other members of the B-complex, as well as in ash." (Cereal Chem. 19, 529 (1942)).

Wilder, Russell M., Han., 1943, Vitamin B_1 (Thiamin), Annals of the American Academy of Political and Social Science, 225, (280.9 Am34), page 29:
"White patent flour retains little more than a tenth of the thiamine in wheat; and bread makes up a sizable fraction of the average diet." "Basing calculations on the disappearance of food products of human consumption in the United States, Lane and co-workers (J. Nutrition, 23, 613-24, June 1943) conclude that the total provision of thiamine does not exceed an average of 0.32 mg. per 1,000 calories. This figure equals that defined by the United States Food and Drug Administration as the minimal daily adult requirement necessary to prevent actual disease. The minimal daily requirement to prevent biochemical abnormality, as determined by Williams and co-workers, is 0.45 mg. per 1,000 calories. The allowance recommended by the Food and Nutrition Board of the National Research Council is 0.6 mg. per 1,000 calories. If the average person receives only 0.32 mg. per 1,000 calories, it should be obvious that millions of our population are suffering from actual deficiency disease and that relatively few diets provide enough thiamine for full health and efficiency."

Nutrition Reviews, The Nutrition Foundation, Inc., Chrysler Building, N.Y.C., December 1942, 2, page 54: "In a tabulation of the thiamine in the foods used to make up the "average American diet", it appears that cereals and meat each supply about one-fourth of the total thiamine eaten, dairy products and vegetables supply one-fifth, and fruits about one-tenth. Interestingly enough, in the table showing the contribution of various foods to the total diet, pork, milk, and bread appear as principal contributors. It is estimated that if the conventional white bread were replaced by "enriched bread" in such a diet, the cereals would supply one-half of the totalthiamine and would raise the average intake of 0.78 mg. to 1.28 mg. per 2500 calories. Thus it appears that the use of whole wheat or enriched bread can raise the thiamine value of the "average American diet" from more than 20 percent below to almost 30 percent above the minimum requirement (about 1 mg.) of thiamine as reported recently by Melnick. In other words, the thiamine value would thus be raised to about 0.5 mg. per 1000 calories but it would still fall short of the 0.6 mg. per 1000 calories recommended by the National Research Council for good nutrition." from: Lane, Johnson, and Williams (Journal of Nutrition, 23, 613 (1942)), studies to determine the thiamine content of the average American diet.

MATERIAL: Milled, Processed, Enriched

THIAMIN I:

Nutrition Review, The Nutrition Foundation, Inc., Chrysler Building, N.Y.C., January 1943, p. page 72: "White flour of a hundred years ago was probably an excellent source of thiamine."
"It was concluded that the best white flours of a century ago must have contained concentrations of thiamine comparable to those of the whole grains from which they were made. In a footnote, the authors state that further work has shown that stone milled flours are also proportionately richer in other members of the B-complex, as well as in iron." (Cereal Chem. 19, 529 (1942)).

Wilder, Russell M., Ibid., 1943, Vitamin B1 (Thiamin), Annals of the American Academy of Political and Social Science, 225, (2TO.) Jan(1), page 2:
"White patent flour retains little more than a tenth of the thiamine in wheat; and bread makes up a sizable fraction of the average diet." "Basing calculations on the disappearance of food products of human consumption in the United States, Hume and co-workers (J. Nutrition, 23, 213-24, June 1942) conclude that the total production of thiamine does not exceed an average of 0.38 mg. per 1,000 calories. This figure equals that defined by the United States Food and Drug Administration as the minimal daily adult requirement necessary to prevent nutrial disease. The minimal daily requ requirement to prevent biochemical abnormality, as determined by Williams and co-workers, is 0.45 mg. per 1,000 calories. The allowance recommended by the Food and Nutrition Board of the National Research Council is 0.6 mg. per 1,000 calories. If the average person requires only 0.38 mg. per 1,000 calories, it should be obvious that millions of our population are suffering from actual deficiency disease and that relatively few diets provide enough thiamine for full health and efficiency."

Nutrition Review, The Nutrition Foundation, Inc., Chrysler Building, N.Y.C., December 1942, 2, page 24: "In a table listing of the thiamine in the foods used to make up the average American diet", it appears that cereals and meat meet nearly about one-fourth of the total thiamine eaten, dairy products and vegetables supply one-fifth, and fruits about one-tenth. Interestingly enough, in the table listing the contribution of various foods to the total diet, rice, milk, and bread appear as principal contributors. It is mentioned that if the enrichment of white bread were replaced by "enriched bread" in such a diet, the cereals would supply one-half of the total thiamine and would raise the average intake of 0.77 mg. to 1.22 mg. per 2700 calories. Thus it appears that the use of whole wheat or enriched bread can raise the thiamine intake of the "average American diet" from more than 25 percent below to almost 50 percent above the minimum requirement (about 1 mg.) for thiamine as reported recently by Wilder. In other words, the thiamine value would thus be raised to about 0.5 mg. per 1000 calories but it would still fall short of the 0.6 mg. per 1000 calories recommended by the National Research Council for good nutrition." Hume Lewis, Johnson, and Williams (Journal of Nutrition, 24, 213 (1942)), studied in detail the thiamine content of the average American diet.

CEREALS: Whole, Processed, Enriched

THIAMIN IN:

The Journal of the American Dietetic Association, April, 1942, "Why Enriched Bread?", by Williams and Wilder: "The most important source of thiamin among the foods consumed in amounts large enough to matter is wheat. A first result of deficiency of thiamin is loss of courage and the will to do or die. Insufficiency of this vitamin in many diets comes mostly from use of ordinary white flour and its products. Therefore it is extremely urgent that thiamin be put back into flour and bread at once."

Nutrition Reviews, The Nutrition Foundation, Inc., Chrysler Bldg., N.Y.C. Nov., 1942, 1, page 11: "Thus we know that Thiamine, riboflavin, and pyridoxine are concentrated in the germ portion of the wheat but niacin and pantothenic acid are not." from studies by Tepy, Strong, and Elvehjem (J. Nutrition 24, 167 (1942).)

CEREALS: Whole, Processed, Enriched

NIACIN In:

Annual Review of Biochemistry, Stanford University Press, 1943,(381 An7 vol.12), page 327: "Acid or alkaline digestion converts unknown substances in grains into niacin and thus tends to yield high values." from: Cheldelin, V. H., and Williams, R. R., Ind. Eng. Anal. Ed., 14, 671-675 (1942).

Nutrition Reviews, The Nutrition Foundation, Inc., Chrysler Bldg., N.Y.C., Feb. 1943, 4, page 121: "No loss of nicotinic acid occurs in the production of bread from enriched white flour or from whole wheat flour (Cereal Chem. 19, 553 (1942)".

Nutrition Review, The Nutrition Foundation, In., Chrysler Bldg., N.Y.C., Nov. 1942, 1, page 4: "Corn, oats, and rye range from 10 to 15 micrograms per gram, but buckwheat, barley, and wheat are considerably higher, 45 to 70 micrograms per gram. As expected, most of the vitamin is present in the bran and middlings". "Peanut butter, however, contains 186 micrograms per gram and ranks with liver as a source of niacin."

Page 11: "A recent study by Tepy , Strong and Elvehjem (J.Nutrition 24, 167 (1942)) fills several gaps in our knowledge of the contribution of wheat and wheat products to the dietary intake of niacin, pantothenic acid and pyridoxine.

"Four varieties of dark hard winter wheat, each grown in four different localities of Kansas and Nebraska, were analyzed. Neither varietal nor environmental differences seemed to exert a significant influence on the amount of pantothenic acid and pyridoxine present. The niacin content was apparently dependent to some extent on both the variety and the environment. However, all the above samples, and most of some 40 miscellaneous wheats, contained from 55 to 65 micrograms of niacin, 10 to 15 micrograms of pantothenic acid, and 4.0 to 5.0 micrograms of pyridoxine per g. of wheat.

"Fifty samples of milled patent and clear flours indicate that the milling loss of niacin, pantothenic acid, and pyridoxine is approximately 83, 57, and 52 percent respectively for patent flour and 64, 28, and 15 percent respectively for the first clear flour.

"Wheat germ contains only 34 micrograms per g. of nicotinic acid, 9.6 of pyridoxine, and 15 of pantothenic acid.

"Thus we know that thiamine, riboflavin, and pyridoxine are concentrated in the germ portion of the wheat but niacin and pantothenic acid are not. The addition of small amounts of the germ to flour would not be an effective means of raising the concentration of the latter two vitamins in flour or bread, and it would appear that the nutritional improvement given to bread by including 5 percent of germ cannot be attributed to the addition of these two members of the B-complex."

The Journal of the American Dietetic Association, April 1942, "Why Enriched Bread?", by Williams and Wilder: "A first result of deficiency of thiamin is loss of courage and the will to do or die. Insufficiency of this vitamin in many diets comes mostly from use of ordinary white flour and its products. Therefore it is extremely urgent that thiamin be put back into flour and bread at once. This argument applies with equal force to niacin."

GENERAL: Whole, Cross and Enriched

VIAMIN In:

Annual Review of Biochemistry, Stanford University Press, 1943, (381 Ann vol.12), page 387: "Acid or alkaline digestion converts unknown substances in grains into niacin and thus tends to yield high values." From: Chemistry, N. Y., and Allied, N. Y., Ind. Eng. Chem. Ed., 14, (171-675 (1942).

Nutrition Review, The Nutrition Foundation, Inc., Chrysler Bldg., N.Y.C., Feb. 1942, p. page 1?1: "No loss of niacinamide could occurs in the production of bread from enriched white flour or from whole wheat flour (durum) flour. 19, 73 (1942)".

Nutrition Review, The Nutrition Foundation, Inc., Chrysler Bldg., N.Y.C., Jan. 1942, p. page 1: "Corn, oats, and rye range from 10 to 15 micrograms per gram, but buckwheat, barley, and wheat are considerably higher, 45 to 70 micrograms per gram. As expected, most of the vitamin is present in the bran and middlings". "Germ butter, however, contains 150 micrograms per gram and ranks with liver as a source of niacin."

Page 11: "A recent study by Tony, Strong and Tresbon (J.Nutrition 24, 147 (1942)) cited several pages in our knowledge of the nutritional value of wheat and wheat products to the dietary intake of niacin, nicotinamide and pyridoxine.

"Four varieties of dark hard winter wheat, each grown in four different localities of Kansas and Nebraska, were analyzed. Neither varietal nor environmental differences proved to exert a significant influence on the amount of pantothenic acid and pyridoxine present. The niacin content was apparently dependent to some extent on both the variety and the environment. However, all the above samples, and most of some 40 miscellaneous wheats, contained from 55 to 65 micrograms of niacin, 10 to 15 micrograms of pantothenic acid, and 4.0 to 5.4 micrograms of pyridoxine per g. of wheat.

"Fifty samples of milled patent and clear flours indicate that the milling loss of niacin, pantothenic acid, and pyridoxine is approximately 50, 70, and 80 percent respectively for patent flour and 40, 20, and 15 percent respectively for the first clear flour.

"Wheat germ contains only 34 micrograms per g. of pantothenic acid, 9.6 of pyridoxine, and 15 of pantothenic acid.

"From we know what vitamins, minerals, and proteins are concentrated in the germ, perhaps the wheat but niacin and pantothenic acid are not. The addition of small amounts of the germ to flour would not be an effective means of raising the concentration of the latter two vitamins in flour or bread, and it would appear that the nutritional improvement given to bread by incorporating 5 percent of germ cannot be attributed to the addition of these two members of the B-complex."

The Journal of the American Dietetic Association, April 1942, "Why Enriched Bread?", by Williams and Mitcher: "Since vitamin of deficiency of niacin is loss of sources and the will go on or the. Insufficiency of this vitamin in many diets comes mostly from use of cereals with flour and its products. Therefore it is extremely urgent that vitamin be put back into flour and bread at once. This argument applies with equal force to niacin."

CEREALS, Whole, Processed, Enriched

NIACIN IN:

Nutrition Reviews, The Nutrition Foundation, Inc., Chrysler Bldg., N.Y.C., Nov., 1942, 1, page 11: "Thus we know that Thiamine, riboflavin, and pyridoxine are concentrated in the germ portion of the wheat but niacin and pantothenic acid are not." from studies by Tepy, Strong, and Elvehjem (J. Nutrition 24, 167 (1942))

Cereal Chemistry, American Association of Cereal Chemists (Lancaster, Pa.), September, 1943, Volume xx (59,8,C33), page 557: "The fact that nearly half the total niacin of the wheat appears in the bran stream leads to the conclusion that the niacin of the wheat kernel must be largely contained in the branny layers. The data also show that the site of the highest concentration of niacin in the wheat kernel is quite different from the site of the thiamin."

GERMAN, Whole, Processed, Enriched

NIACIN ( )

Nutrition Reviews, The Nutrition Foundation, Inc., Chrysler Bldg., N.Y.C., Nov., 1942, 1, pp. 11: "Thus we know that Thiamine, riboflavin, and pyridoxine are concentrated in the germ portion of the wheat kernel and pantothenic acid are not." From studies by Tepp, Stern, and Elvehjem (J. Nutrition 24, 167 (1942))

Cereal Chemistry, American Association of Cereal Chemists (Lancaster, Pa.), Quarterly, 1943, Volume xx (59,2,253), page 257: "The fact that nearly half the total niacin of the wheat appears in the germ stream leads to the conclusion that the niacin of the wheat kernel must be largely concentrated in the bran layers. The data also show that the site of the highest concentration of niacin in the wheat kernel is quite different from the site of the thiamin."

CEREALS: Whole, Processed, Enriched

RIBOFLAVIN In:

Annual Review of Biochemistry, Stanford Univ. Press, 1943, (381 An7 Vol.12), page 325: "A parallel was found between the thiamin and riboflavin contents of cereals and milled products." from: Andrews, J. S., Boyd, H. M., and Terry, D. E., Cereal Chemistry, 19, 55-64 (1942)

- "Other investigators reported the existance of factors in photolyzed extracts of whole wheat flour and in extracts of rice and wheat bran which stimulate acid production and interfere with the proper evaluation of the riboflavin content of cereal products." from: Wegner, M. I., Kemmerer, A. R., and Fraps, G. S., Journal of Biological Chemistry, 144, 731-35 (1942).

"Light destruction of riboflavin in foods has been found to be rapid and to be influenced by pH and temperature, which are secondary factors."
from: Williams, R. R., and Cheldelin, V. H., Science, 96, 22-23(1942).

"Sliced bread may lose riboflavin by being exposed to light under ordinary conditions." from: Andrews, J. S., Boyd, H. M., and Terry, D. E., Cereal Chemistry, 19, 55-64 (1942).

Sherman, H. C., and Lanford, Caroline S., Essentials of Nutrition, MacMillan Company, N.Y.C., 1943, page 226: "Whole wheat contains only about one-fourth as much riboflavin as thiamin. The germ or embryo is richer in both of these factors than is the entire grain."

Batchelder, Esther L., Jan. 1943, "Riboflavin", Annals of the American Academy of Political and Social Sciences, 225, (280.9 Am.34), page 32: "Reports of widespread occurance of riboflavin deficiency disease, diagnosed by qualified observers, indicates that the diet of many Americans is too low in this factor. Milk, liver, kidney, and eggs are generally recognized as dependable sources of this factor. Whole-grain cereals are not very rich on a weight basis, but if used instead of refined products, can appreciably increase the intake of this vitamin."

Nutrition Reviews, The Nutrition Foundation, Inc., Chrysler Bldg., N.Y.C., Nov. 1942, 1, page 11: "Thus we know that Thiamin, riboflavin, and pyridoxine are concentrated in the germ portion of the wheat but niacin and pantothenic acid are not." from studies by Tepy, Strong, and Elvehjem (J. Nutrition 24, 167 (1942)).

RIBOFLAVIN In:

Annual Review of Biochemistry, Stanford Univ. Press, 1943, (391 Arf Vol.12), page 397: "A parallel was found between the thiamin and riboflavin contents of cereals and milled products." From: Andrews, J. C., Ford, M. E., and Perry, G. H., Cereal Chemistry, 19, 55-61 (1942) "Other investigators reported the existence of factors in phosphorylated extracts of whole wheat flour and in extracts of rice and wheat bran which stimulate acid production and interfere with the proper evaluation of the riboflavin content of cereal products." From: Geyer, R. P., Kerewer, A. I., and Evans, C. D., Journal of Biological Chemistry, 144, 723-35 (1942).

"Light deterioration of riboflavin in foods has been found to be rapid and to be influenced by pH and temperature, which are secondary factors."

From: Williams, R. R., and Waldbott, T. G., Science, 96, 22-23 (1942).

"Milled bread was less riboflavin by being exposed to light under ordinary conditions." From: Andrews, J. C., Boyd, H. M., and Perry, G. H., Cereal Chemistry, 19, 55-61 (1942).

Harrow, B. A., and Sherman, H. C., Essentials of Nutrition, 3rd Edition, Macmillan Company, N.Y., 1943, page 324: "Whole wheat contains only about one-fourth as much riboflavin as thiamin. The germ or embryo is richer in both of these factors than is the entire grain."

Sebrell, Robert W., Jr., Jan. 1943, "Riboflavin", Annals of the American Academy of Political and Social Sciences, 225, (Nov. 9 to 43), page 32: "Reports of widespread occurrence of riboflavin deficiency diseases, discovered by qualified observers, indicated that the diet of many Americans is not too in this regard. Milk, liver, kidney, and eggs are generally recognized as dependable sources of this factor. Whole-grain cereals are not very rich on a weight basis, but if used instead of refined products, can appreciably increase the intake of this vitamin."

Nutrition Review, The Nutrition Foundation, Inc., Chrysler Bldg., N.Y.C., Nov. 1942, 1, page 11: "Time to know that Niacin, riboflavin, and pyridoxine are concentrated in the germ portion of the wheat but niacin and pantothenic acid are not." From studies by Lepp, Strong, and Kiesselbach (J. Nutrition 24, 187 (1942)).

CEREALS: Whole, Processed, Enriched

PANTOTHENIC ACID In:

The Journal of Nutrition, August 10, 1943, vol.26, no. 2, page 137, "Digestion of Whole Wheat and White Breads in the Human Stomach", by Rosterfer, Kochakian, and Murlin (Rochester Univ.): "The peeled-wheat bread with high-vitamin yeast undergoes gastric proteolytic digestion 15% faster than when the bread is baked with ordinary bakers' yeast; the free sugar formation under the amylolytic action of saliva is 11% faster. Calcium pantothenate in 16 mg. doses taken at least twice before the meal (8 to 10 hours and 1 hour) accelerates the two digestion rates to about the same extent. Pantothenic acid in the test meal of high vitamin yeast bread exceeded that of the same bread baked with ordinary yeast by only 0.45 mg. If this is the only vitamin B-factor affecting digestion rates, it appears that a relatively small amount in the bread is as effective as a much larger amount taken before the meal."

Nutrition Reviews, the Nutrition Foundation, Inc., Chrysler Bldg., N.Y.C., Nov. 1942, 1, page 11: "Thus we know that Thiamine, riboflavin, and pyridoxine are concentrated in the germ portion of the wheat but niacin and pantothenic acid are not." from studies by Tepy, Strong and Elvehjem (J. Nutrition 24, 167 (1942)).

The Journal of Nutrition, August 10, 1943, vol.26, No.2, page 172, "The Effects of Pantothenic Acid and Inositol Added to Whole Wheat Bread on Evacuation Time, Digestion and Absorption in the Upper Gastro-Intestinal Tract of Dogs", by Bly, Heggeness, and Nadset (Univ. of Rochester): In enterostomized dogs maintained exclusively on a peeled whole wheat diet, a severe deficiency was produced in the course of 2 to 3 months. This was characterized by an approximately 50% decrease in gastrointestinal motility, accompanied by 40-60% decrease in the rates of carbohydrate and protein digestion and absorption. The almost immediate effect of adding a supplement of 220 ug. of calcium pantothenate per kilogram of dog weight per day to this diet was the return of these functions to normal in every case. The total digestion remained practically the same in the normal deficient states.

"Pyridoxine was ineffective in altering the course of the deficiency.

"Inositol acted more as a cathartic, its effect being apparently superimposed on the deficiency. While the motility was temporarily improved, the total amounts and rates of digestion and absorption were greatly decreased."

Cereals: Whole, Enriched, Fortified

Bibliography

The Journal of Nutrition, August 1, 1943, vol.26, no. 2, page 127, "Digestion of Yeast and White Bread in the Human Stomach", by Lactofer, Lactobacillus, and Pepsin (Fleischer Univ.): "The yeast-wheat bread with high-vitamin yeast maintains gastric proteolytic digestion for longer than when the bread is baked with ordinary baker's yeast; the longer digestion under the stimulatory action of malva is due to lactofer. Gastric proteolysis in 16 hr. doses taken at least three hours before the meal (2 to 10 hours and 1 hour) accelerates the low digestion rates in about the same amount. Hydrochloric acid in the meal of with vitamin yeast brought exceeded that of the same meal baked with ordinary yeast in only 0.05 hr. If this is the only vitamin B-factor effective in digestion rates, it appears that a relatively small amount in the bread is as effective as a much larger amount taken before the meal."

Nutrition Reviews, the nutrition foundation, Inc., Cornelia Ellis, M.D., Vol. 1, No. 11. "Tests on Iron Rich Baking Ribboflavin and pyridoxine are concentrated in the germ portion of the wheat and cereals and nutritionists and M. Ann. Iron absorbed by Iron Tablets and Iron (d. Jacobson 21, 127 (1942)).

The Journal of Nutrition, August 10, 1943, vol.26, No.2, page 172, "The Effects of Thiamine Deficiency and Inadequate Intake to Dogs Fed on Synthetic Diet, Digestion and Absorption in the Upper Gastro-Intestinal Tract of Dogs", by Ely, Hoggenson, and Hadert (Univ. of Indiana): In gastrointestinal dogs maintaining equilibrium on a purine whole wheat diet, a severe deficiency was produced in the course of 2 to 3 months. This was characterized by an approximately 30% decrease in gastrointestinal motility, accompanied by 15-63% decrease in the rates of carbohydrate and protein digestion and absorption. The short intestine effect of adding a sufficient of 200 mg. of active pantothenate per kilogram of dog weight per day to this diet was the return of these functions to normal in every case. The total digestion remained practically the same in the normal controlled states.

"Pantothenic was the factor in altering the course of the deficiency.

"Tissue extract were as a control, the effect being consequently superimposed on the deficiency. While the motility was temporarily improved, the total gastric and rates of digestion and absorption were greatly decreased."

CEREALS, Whole, Processed, Enriched

PYRIDOXINE IN:

Nutrition Reviews, The Nutrition Foundation, Inc., Chrysler Bldg., N.Y.C., Nov., 1942, 1, page 11: "Thus we know that Thiamine, riboflavin, and pyridoxine are concentrated in the germ portion of the wheat but niacin and pantothenic acid are not." from studies by Tepy, Strong, and Elvehjem (J. Nutrition 24, 167 (1942))

The Journal of Nutrition, August 10, 1943, Vol. 26, No. 2 (389.8 J82), page 172, "Whole Wheat Bread and Gast. Int. Tract", by Bly and Others (Univ. of Rochester): "In enterostomized dogs maintained exclusively on a peeled whole wheat diet, a severe dificiency was produced in the course of 2 or 3 months . . . . . .

"Pyridoxine was ineffective in altering the course of the deficiency."

CRITICAL, Whole, Processed, Purished

REFERENCE IN:

Nutrition Review, The Nutrition Foundation, Inc., Chrysler Bldg., N.Y.N.Y., Vol., 1942, 1, page 11: "Thus we know that Thiamin, riboflavin, and nicotinic are concentrated in the germ portion of the wheat but niacin and pantothenic acid are not." From studies by Tony, Strong, and Eversden (L. Nutrition 24, 157 (1942))

Journal of Nutrition, August 10, 1942, Vol. 24, No. 2 (Pgs. 152), page 152, "Vital Wheat Germ and Yeast. Inc. Yeast, by Ely and Oldham (Univ. of Iowa). In enhancedmined dge maintained exclusively on a pelled whole wheat diet, a severe difficulty was produced in the course of 2 or 3 months . . . . . .

"Riboflavin was ineffective in alleviating the course of the deficiency."

CEREALS: Whole, Processed, Enriched

MANGANESE IN:

Cereal Chemistry, Lancaster, Pa., Vol XX, No. 3, May, 1943, "The Manganese Content of Bread and Wheat Products" (page 328) by Schweitzer and Dalby of Ward Baking Co., N.Y.C.: Experiments in this laboratory show that the manganese content of a loaf of bread serves as an indicator of the degree of extraction of the flour used in making the loaf. The fact that manganese varies with the ash of a flour has been known for some time. . . . McCarrison (1927) pointed out that the milling of cereals reduces the manganese in the diet below the safety point and favored the use of whole wheat bread by children because of its higher manganese content. . . . Manganese and ash are closely related factors. Whole wheat flours average 35-40 micrograms per gram, whereas standard patent flours average about 4 micrograms per gram."

MATERIALS I:

Cereal Chemistry, Lancaster, Pa., Vol. IX, No. 5, Sep., 1932, "The Importance of Bread and Wheat Products" (page 723) by Bolmeister and Kelly of Ward Baking Co., N.Y.C.: Experiments in this laboratory show that the vitamine content of a loaf of bread serves as an indicator of the degree of extraction of the flour used in making the loaf. The less this vitamine varies with the rate of a flour has been in use for more time. . . . Bolmeister (1927) pointed out that the utility of cereals reduces the vitamines in the diet below the safety point and favored the use of whole wheat bread by children because of its higher vitamine content. . . . Manganese and ash are closely related factors. Whole wheat flours average 35-40 micrograms per gram, whereas standard patent flours average about 4 micrograms per gram.

CEREALS: Whole, Processed, Enriched

IRON In:

Annual Review of Biochemistry, Stanford University Press, 1943,(381 An7 vol.12), page 259: "Free and Bing reported that several varieties of wheat contained 2.90 to 4.87 mg. of total iron per 100 gm. Chemical studies indicated the iron was 73 to 88 percent ionizable, and in studies with rats the iron of two varieties of wheat was found to cause almost as much hemoglobin regeneration as equal amounts of ferric chloride." from: Free, A. H., and Bing, F. C., Journal of Nutrition, 19, 449-60 (1940)
"On the basis of long-time balance studies with adult human subjects, Widdowson and McCance found that iron was well absorbed from a diet in which white flour bread constituted 40 to 50 percent of the calories. Iron was less efficiently absorbed, however, from similar diets when the white flour was replaced with a flour of 92 percent extraction." from: Widdowson, E. M. and McCance, R. A., Lancet, 1, 588-90 (1942)

Nutrition Reviews, July 1943, The Nutr. Foundations, Inc., Chrysler Bldg., N.Y.C., 9, page 269: "Nakamura and Mitchell (J. Nutrition 25, 39, (1943)) point out that difficulties may be encountered in meeting the federal specifications regarding the addition of iron to flour as part of the enrichment program. Iron salts which are not insoluable may cause adverse reactions such as rancidity in the flour. A study was made, therefore, of the degree to which the several iron salts commonly incorporated in flour (iron phytate, sodium iron pyrophosphate, and ferrum reductum) were utilized for the production of hemoglobin." "The iron in sodium iron pyrophosphate and in ferrum reductum was as well utilized as was the iron in ferric chloride. The iron in ferric phytate, however, proved to be definitely inferior and stimulated hemoglobin formation only about half as much as did ferric chloride.
"Widdowson and McCance (Lancet 1, 558 (1942)) obtained some evidence that human subjects utilize the iron of white bread more completely than the iron of 92 percent extraction bread. This may be related to the fact that iron phytate occurs only in the outer layers of the wheat kernel while the iron in patent flour is largely inorganic, and originates to a considerable extent from the milling process."

Sherman, H. C., and Constance S. Pearson, Modern Bread, MacMillan Co., 1942, (389.1 Sh5M), page 41: "Rose and Vahlteich (1932) found the iron of whole wheat and of bran, as also of oatmeal, to be effective in hemoglobin formation. Patent flour also fostered hemoglobin to some extent; but patent flour with added iron was not so effective as the same total amount of iron in the form of whole wheat. They concluded that either the iron in oatmeal and whole wheat is more effective than that of white flour enriched with iron, or that the whole-grain products contain something else as well as iron which is favorable to the assimilation of iron and the formation of hemoglobin."

Iron in:

Annual Review of Biochemistry, Stanford University Press, 1942, (301 and 307 var.192), page 1291. Hess and Ping reported that several varieties of wheat contained 2.00 to 4.97 mg. of total iron per 100 gm. Chemical studies indicated the iron was 75 to 90 percent ionizable, and in studies with rats the iron of the varieties of wheat was found to agree almost as much hemoglobin regeneration as equal amounts of ferric chloride." from: Hess, A. E., and Ping, M. C., Journal of Nutrition, 19, 493-500 (1940)

"In the tests of long-time balance studies with adult human subjects, iron and tolerance found that iron was well absorbed from a diet in which white flour bread constituted 40 to 50 percent of the calories. Iron was less efficiently absorbed, however, from similar diets when the white flour was replaced with a flour of 92 percent extraction." from: Hawkins, E. K. and Robson, K. A., Lancet, 1, 529-30 (1942)

Nutrition Review, July 1943, The Wm. Leonhardtone, Inc., Surgeler Bldg., N.Y.C., page 206: "Hawkins and Stotzell (J. Nutrition 25, 29, (1943)) point out that difficulties may be encountered in studying the federal specifications regarding the addition of iron to flour as part of the enrichment program. Iron salts which are not reactions may cause adverse reactions such as rancidity in the flour. A study was made, therefore, of the degree to which the several iron salts commonly incorporated in flour (iron phytate, ferrous iron pyrophosphate, and ferrous reduction) were utilized for the production of hemoglobin." "The iron in sodium iron pyrophosphate and in ferrous reduction was as well utilized as was the iron in ferric chloride. The iron in ferric phytate, however, proved to be definitely inferior and utilized hemoglobin formation only about half as much as did ferric chloride.

"Hawkins and Robson (Lancet 1, 529 (1942)) obtained some evidence that human subjects utilize the iron of white bread more completely than the iron of 92 percent extraction bread. This may be related to the fact that iron phytate occurs only in the outer layers of the wheat kernel while the iron in patent flour is largely inorganic and originates to a considerable extent from the milling process." Sherman, H. C., and Chatelaine E. Lerew, Nutrition Review, Macmillan Co., 1942, (Vol. 1, No.8), page 241: "Use of 'Enrichment' (1942) found the iron in white bread was of less, or also of doubtful, to be effective in hemoglobin formation. Tests also indicated hemoglobin to some extent but white flour with added iron was not so effective as the same amount of iron in the form of whole wheat. They concluded that either the iron in general and whole wheat is more effective than that of white flour enriched with iron, or that the phytic-iron complexes contain something else as well as iron which is favorable to the assimilation of iron and the formation of hemoglobin."

CEREALS: Whole, Processed, Enriched

IRON In:

Sherman, H. C., and Constance, S. Pearson, Modern Bread, MacMillan Co., 1942 (389.1 Sh5M), page 96: "Addition of iron is thought by British experts to involve a risk to the stability of some of the other nutrients of the flour and is therefore not recommended for the British "national bread".

"Meanwhile, in America the addition of iron to white flour is already being practiced to a considerable extent, while the addition of calcium is still only tentatively suggested."

page 101: "Whole wheat is an excellent source of nutritionally efficient iron; but about four-fifths of it has been and is rejected in the milling of ordinary white flour, Enriched white flour is, in the United States, to have at least a significent share of the original iron content restored."

The Journal of Nutrition, August 10, 1943, (389, 8 J82), page 194, "A Study of the Availability of the Iron in Enriched Bread": "Sodium iron pyrophosphate, administered to rats maintained on a diet of whole milk, has been found to have an availability of considerably less than 50% as compared to the utilization of ferrour or ferric sulfate. Likewise, when enriched bread containing sodium iron pyrophosphate or ferrous sulfate was fed to anemic rats, the availability of the former compound was less than 50% of that of the ferrous sulfate.

"After this paper was submitted, an article appeared by Nakamura and Mitchell ('43), which calls for comment. These workers reported that the utilization of iron as sodium iron pyrosphosphate or ferric chloride is equally satisfactory as tested in anemic rats. It is difficult to reconcile these findings with those reported here. Mitchel ('43) has pointed out that in their experiment the iron compounds were administered daily, in constrast to the thrice-weekly administration of the iron salts in the present study. However while this might account in part for the difference observed when the iron salts were administered as such, it would not explain the poor utilization of sodium iron pyrophosphate when fed in enriched bread ad libitum. It should also be pointed out that while the preparations of sodium iron pyrophosphate were obtained from the same manufacturer, they were, of course, different samples, and this might to some extent account for the variation in degree of utilization."

Warren, T. W., and Constance, S. Iverson, Iodine Bread, Sodium Co., 1942 (39).1 8145(). note 06: "Addition of iron is thought by British experts to involve a risk to the stability of some of the other nutrients of the flour and is therefore not recommended for the British "national bread".

"Recently, in America the addition of iron to white flour is already being practiced to a considerable extent, while the addition of calcium is still only tentatively suggested."

The Journal of Nutrition, August 10, 1942 (39), 3 382) page 1[illegible], "A study of the availability of the iron in "enriched bread", "sodium iron pyrophosphate, administered to rats maintained on a diet of whole milk, has been found to have an availability of considerably less than 50% as compared to the utilization of ferrous or ferric sulfate. However, when enriched bread containing sodium iron pyrophosphate or ferrous sulfate was fed to growing rats, the availability of the ferrous sulfate was less than 50% of that of the ferrous sulfate.

"After this paper was submitted, an article appeared by Weissman and Kitchell (1943), which calls for comment. Those workers report that the utilization of iron as sodium iron pyrophosphate or ferric chloride is equally satisfactory as judged in anemic rats. It is difficult to reconcile these findings with those reported here. Kendall (1943) has pointed out that in their experiment the iron compounds were administered daily, in contrast to the intermittent administration of the iron salts in the present study. Possibly this difference accounts in part for the difference observed. However, this cannot be the major account in part for the difference observed when the iron salts were administered as bread. It would not explain the poor utilization of sodium iron pyrophosphate when fed in the form of bread. It should also be pointed out that material based on [illegible] proportions of sodium iron pyrophosphate were obtained while the preparations of sodium iron pyrophosphate were obtained from the same manufacturer, they were, of course, different samples and this might lead to some unknown account for the variation in degree of utilization."

CEREALS: Whole, Processed, Enriched

PROTEIN IN:

Nutrition Reviews, The Nutrition Foundations, Inc., Chrysler Bldg., N.Y.C., 5, March 1943, page 131: "It is inevitable in wartime to find a shortage of meat and dairy products, our most valuable source of good protein. The possibility of extending the protein supply of the diet by more effective use of wheat has received consideration. The by-products of the milling of white flour not only are richer in iron and in the vitamins of the B-complex, but they also have a higher protein content. Would there be any advantage from the point of view of the proteins, if whole wheat flour were substituted for white flour? Two recent reports show conclusively that whole wheat flour is digested almost as completely as white flour, and that its proteins are of higher biologic value."

Food Field Reporter, N.Y.C., Sept. 6, 1943, "Proteins of Whole Wheat Surpass White Flour", page 24: "The Biologic value of the proteins in whole wheat flour was found to be superior to that in white flour in studies done by Chick and reported in the English Journal "Lancet". His work was commented on in a recent issue of "Nutrition Reviews".

"Experiments showed that 19.5 grams of the proteins of whole wheat were as useful to the rat as 13.1 grams of white flour proteins.

"In two experiments it was found that 87.9 and 86.8 percent of the protein in white flour was digested and absorbed as compared to 85.4 and 83.2 and 81.7 in whole wheat meal. This investigation pointed out that the slight difference in digestibility favoring white flour is more than compensated for by the greater biologic value of national wheat meal or by the whole wheat meal in the promotion of growth."

NOTES, 14:

Nutrition Reviews, The Nutrition Foundation, Inc., Chrysler Bldg., N.Y.C.,
5, March 1943, page 121: "It is inevitable in wartime to find a
shortage of meat and dairy products, our most valuable sources of
good protein. The possibility of extending the protein supply
of the diet by more effective use of wheat has received consider-
ation. The by-products of the milling of white flour not only are
richer in iron and in the vitamins of the B-complex, but they also
have a higher protein content. Could there be any advantage from
the point of view of the problem, if whole wheat flour were sub-
stituted for white flour? Two recent reports show conclusively
that whole wheat flour is digested almost as completely as white
flour, and that its proteins are of higher biologic value."

Food Field Reporter, N.Y.C., Sept. 6, 1943, "Proteins of Whole Wheat
Compare With Flour", page 21: "The Biologic value of the proteins
in whole wheat flour was found to be superior to that in white flour
in studies done by Ohlson and reported in the English Journal "Lancet"
The work was commented on in a recent issue of "Nutrition Reviews".

"Experiments showed that 10.5 grams of the proteins of white
wheat were as useful to the rat as 15.1 grams of white flour proteins.

"In two experiments it was found that 87.0 and 86.8 percent of
the protein in white flour was digested and absorbed as compared to
85.4 and 83.0 and 81.7 in whole wheat meal. This investigation
pointed out that the slight difference in digestibility favoring
white flour is more than compensated for by the greater biologic
value of protein of wheat meal or the whole wheat meal in the
production of growth."

CEREALS: Whole, Processed, Enriched

CALCIUM ADDED:

Sherman, H. C., and Constance S. Pearson, Modern Bread, MacMillian Co., 1942 (389.1Sh5M), page 96: "In the above mentioned British report, it is stated as "known" that intake of calcium in the diets of Great Britain, especially among the poorer classes, is frequently too low for satisfactory nutrition and that calcium is therefore to be added to the national flour.

"Meanwhile, in America the addition of iron to white flour is already being practiced to a considerable extent, while the addition of calcium is still only tentatively suggested.

CEREALS: Whole, Processed, Enriched

DIETARY HABITS IN VARIOUS COUNTRIES:

Journal of the American Dietetic Association, April 1942, "Why Enriched Bread?" by Robert R. Williams and Russell M. Wilder: "The Russian army is fed whole grain. Thus far it is the only army to match successfully the whole-grain eating army of the Nazis. The endurance of the Russian citizen equals the vigor of the Russian soldier. The Russian people eating whole-grain bread receive important nutrients denied to people who depend on ordinary white flour for their bread."

Nutrition Reviews, The Nutrition Foundations, Inc., Chrysler Bldg., N.Y.C., 2, Dec. 1942, page 61: "At present the governmental authorities in England have authorized (1) the production of a "national wheat meal" of 85% extraction, fortified with calcium carbonate, and (2) the addition of thiamine to white flour."

Journal of the American Dietetic Association, April, 1942, "Why Enriched Bread?" by Robert R. Williams and Russell M. Wilder: "We have investigated and found that almost every large baking concern has among its officers some man who has had his fingers burned in an attempt to promote the sale of whole wheat bread or like breads. Yet today less than two percent of all the flour sold is whole wheat flour. The widespread efforts to get people to eat more whole wheat bread have failed, because the public prefers the color,texture and flavor of white bread."

Federal Registers, Washington, D. C., May 27, 1941, June 5, 1943 and July 3, 1943: pages 2578, 7514, and 9116 respectively, (enactments and amendments by the Food and Drug aAdministration): Material is arranged into a table by the compiler.

"Enriched Flour", so labeled and sold in the future, will have the following percentages of added ingredients, or if not--other percentages used will be specifically described on the labels:

UNITS ADDED PER POUND OF FLOUR
AS AMENDED, JULY 3, 1943

		Minimum	Maximum
	Thiamin	2.0 mgs.	2.5 mgs
	Riboflavin	1.2 mgs	1.5 mgs
	Niacin	16. mgs	20. mgs
	Iron	13. mgs	16.5 mgs
Optional	(Calcium	500. mgs	625. mgs
	(Vit. D.	250. U.S.P.	1,000. U.S.P.

Quoted from above source: "(d) it may contain not more than 5 percent by weight of wheat germ or partly defatted wheat germ; and (e) in determining whether the ash content complies with the requirements of this section allowance is made for ash resulting from any added iron or salts of iron or calcium. Iron and calcium may be added only in forms which are harmless and assimilable. The substances referred to in paragraphs (a) and (b) may be added in a harmless carier which does not impair the enriched flour; such carrier is used only in the quantity necessary to effect on intimate and uniform admixture of such substances with the flour."

CEREALS: Whole, Processed, Enriched

DIETARY HABITS IN VARIOUS COUNTRIES:

Time, August 31, 1942, Number 9, page 69, "Nonpoisonour Bread": "In countless articles Professor Sherman has crusaded against our enemy, the wheat loaf, backing up his written views with pictures of laboratory rats who when fed on white bread diet, lost their hair, teeth, whiskers, and eventually grew peaked and died. The 20% decrease in the per capita bread consumption by the U.S. during the past generations has been due partly to the growing emphasis on vitamins and protective foods, partly to the realization that both vitamins and minerals are lost when flour is refined to pure whiteness. As a result, only one-third of the food calories in the United States now come from bread (only 19% in the families of professional men), compared with 40% in most of Europe, 53% in France. Modern Bread, says Dr. Sherman, should bring the U. S. figure up to 40%. This means that two billion pounds would be added to the annual U. S. bread consumption. Professor Sherman recommends the "longer-extraction" of "whole-meal" flour which discards the coating, but utilizes about 85% of the wheat kernel. It is the basis of the British "national loaf".

CEREALS: Whole, Processed, Enriched

FLOUR, GOVERNMENT REGULATION OF, Plain White Wheat:
and Plain White Wheat Enriched:

Federal Registers, Washington, D. C., May 27, 1941, June 5, 1943, and July 3, 1943; pages 2578, 7514, and 9116 respectively, (enactments and amendments by the Food and Drug Administration). "15.000 Flour, White flour, Wheat flour, plain flour - identity; label statement of optional ingredients. (a) Flour, white flour, wheat flour, plain flour, is the food prepared by grinding and bolting cleaned wheat other than durum wheat and red durum wheat; to compensate for any natural deficiency of enzymes, malted wheat, malted wheat flour, malted barley flour, or any combination of two of these, may be used; but the quantity of barley flour so used is not more than 25%. One of the cloths through which the flour is bolted has openings not larger than those of woven wire cloth designated "149 micron (No. 100)" in table I of "Standard Specifications for Sieves", published March 1, 1940, in L. C. 584 of the U. S. Department of Commerce, National Bureau of Standards. The flour is freed from bran coat, or bran coat and germ, to such extent that the percent of ash therein, calculated to a moisture-free basis is not more than the sum of one-twentieth of the percent of protein therein, calculated to a moisture-free basis, and 0.35. Its moisture content is not more than 15 percent. Unless such addition conceals damage or inferiority of the flour or makes it appear better or of greater value than it is, one or any combination of two or more of the following optional bleaching ingredients may be added in a quantity not more than sufficient for bleaching or, in case such ingredient has an artificial aging effect, in a quantity not more than sufficient for bleaching and such artificial aging effect:
(1) oxides of nitrogen, (2) Chlorine, (3) Nitrosyl Chlorine, (4) Nitrogen Trichloride, (5) One part by weight of benzoyl peroxide mixed with not more than six parts by weight of a mixture of either potassium alum or calcium sulfate and magnesium carbonate.
(b) When any optional bleaching ingredient is used, the label shall bear the word "Bleached". Wherever the name of the food appears on the label so conspicuously as to be easily seen under customary conditions of purchase, the word "Bleached" shall immediately and conspicuously precede or follow such name, without intervening written, printed, or graphic matter; except that where such name is a part of a trade-mark or brand other written, printed, or graphic matter, which is also a part of such trade-mark or brand, may so intervene if the word, "Bleached" is in such Juxtaposition with such trademark or brand as to be conspicuously related to such name.
(c) For the purpose of this section: (1) Ash is determined by the method prescribed in the book "Official and Tentative Methods of Analysis of the Association of Official Agricultural Chemists" 5th edition, 1940, page 212, under "Method I--Official". Ash is calculated to a moisture-free basis by subtracting the percent of moisture in the flour form 100, dividing the remainder into the percent of ash, and multiplying the quotient by 100. (2) Protein is 5.7 times the nitrogen as determined by the method prescribed in such book on page 26, under "Kjelkahl-Gunning-Arnold Method--Official". Protein is calculated to a moisture-free

CEREALS: Whole, Processed, Enriched

FLOUR, GOVERNMENT REGULATION OF, Plain White Wheat:
and Plain White Wheat Enriched:

Federal Registers (continued)
basis by subtracting the percent of moisture in the flour from 100, dividing the remainder into the percent of ash, and multiplying the quotient by 100. (3) Moisture is determined by the method prescribed in such book on page 211, under "Vacuum Oven Method--Official".

15.010 Enriched flour - identity; label statement of optional ingredients. Enriched flour conforms to the definition and standard of identity, and is subject to the requirements for label statement of optional ingredients, prescribed for flour by 15.000, except that;"

(a) (b) and (c) digested into table by compiler:
"Enriched" flour of the future will have the following percentages of added ingredients, or if not--other percentages used will be specifically described on the label:

	Units added per pound of Flour			
	ENACTED 1941		AMENDED 1943	
	Minimum	Maximum	Minimum	Maximum
Thiamin	1.66 mgs	2.5 mgs	2.0 mgs	2.5 mgs
Riboflavin	1.2 mgs	1.8 mgs	1.2 mgs	1.5 mgs
Niacin	6. mgs	24. mgs	16. mgs	20. mgs
Iron	6. mgs	24. mgs	13. mgs	16.5 mgs
Optional (Calcium	500. mgs	2,000. mgs	500. mgs	625. mgs
Optional (Vit. D	250. U.S.P.	1,000.U.S.P.	250. U.S.P.	1,000. U.S.P.

"(d) it may contain not more than 5 percent by weight of wheat germ or partly defatted wheat germ; and
(e) in determining whether the ash content complies with the requirements of this section allowance is made for ash resulting from any added iron or salts of iron or calcium. Iron and calcium may be added only in forms which are harmless and assimilable. The substances referred to in paragraphs (a) and (b) may be added in a harmless carrier which does not impair the enriched flour; such carrier is used only in the quantity necessary to effect an intimate and uniform admixture of such substances with the flour."

[illegible] Study, Proposed, Initiated

[illegible] Operation Regulation of, Plain White River;
and Plain White Creek Watershed;

Lateral Tributary (continued)

[illegible] the amount of moisture in the flow from [illegible] by subtracting the amount of moisture in air, and multiplying the remainder into the amount of air, and multiplying the quotient by 100. (2) Moisture is determined by the method prescribed in such book on page 511, under "Sense Dew Point-Psychrometer".

Plain Creek Flow - Minimum Total statement of original [illegible] flow conditions (flow conditions and discharge [illegible]), and is subject to the requirements for lateral statement of [illegible], and is subject to the requirements for flow by 15,000, except of [illegible] prescribed for flow by 15,000, except that:

(a) (2) and (4) Alternate lists shall be in compliance [illegible] "original" flow of the Podgee will have the following percentages of added humidities, or if semi-humidity measurements used will be specifically described on the form:

Table added per cent of flow

	Winter 1915		Summer 1916	
	Station		Station	
Humidity	1.64 mm	2.5 mm	2.0 mm	2.5 mm
Dew point	1.2 mm	1.7 mm	1.2 mm	1.5 mm
Temp.	[illegible] mm	[illegible] mm	[illegible] mm	[illegible] mm
Temp.	[illegible] mm	[illegible] mm	[illegible] mm	[illegible] mm
(Volume)	[illegible] mm	[illegible] mm	[illegible] mm	[illegible] mm
(Volume)	[illegible]	[illegible]	[illegible]	[illegible]

(2) In any analysis not more than 5 percent by weight of wheat may be partly defatted wheat germ; and

(4) In determining whether the mash contents conflicts with the requirements of this section allowance is made for mash containing [illegible] added lime or salts of lime or sulfate. Lime and sulfate may be added only in form which are harmless and available. The [illegible] referred to in paragraphs (3) and (4) may be added in a [illegible] water which does not impair the original flow; such [illegible] water is used only to the minimum necessary to effect an [illegible] and [illegible] of such substance with the flow."

CEREALS: WHOLE, PROCESSED, ENRICHED

COMPARATIVE TABLES CONCERNING "ENRICHMENT", DAILY REQUIREMENTS, ETC.

*Taylor, Clara M., Food Values in Shares and Weights, MacMillan Co., N.Y.C., 1942, pages 2, 54, and 60:
**Federal Registers, Washington, D. C., June 5, 1943--page 7514 and July 3, 1943--page 9116:

I. *Dietary Standards set up in 1941 by the Foods and Nutrition Committee of the National Research Council: Recommended Daily Allowances for Man (70kgs.) Moderately Active:

**Food and Drug Administration (1943) amended legislation (now effective) whereby "Enriched" flour of the future will have the following percentages of added ingredients, or if not--other percentages used will be specifically described on the label. Units Added Per Pound of Flour:

			Minimum	Maximum
Calories	3000			
Protein	70	mgs		
Thiamin	1.8	mgs	2.0 mgs.	2.5 mgs.
Riboflavin	2.7	mgs	1.2 mgs	1.5 mgs
Niacin	18.0	mgs	16.0 mgs	20.0 mgs
Iron	12.0	mgs	13.0 mgs	16.5 mgs
Calcium	800.0	mgs	(500.0 mgs	625.0 mgs
Vitamin D	400.0	U.S.P.	Optional -(250.0 U.S.P.	1000.0 U.S.P.

II. *Food Values of Various Kinds of Bread:

Kind	Approximate Measure	Calories	Protein Gms.	Calcium Mgs.	Iron Mgs.	Vitamin A I.U.	Thiamin (B_1) Mgs.	Ascorbic Acid (C) Mgs.	Riboflavin (G) Mgs.
white (water)	1 slice, 3" x3½" x½"	50	1.3	5	0.18	-	-	-	-
whole wheat 50%	1 slice, 3" x3½" x½"	55	1.3	8	0.33	+	0.039	-	0.017
whole wheat (100% water)	1 slice, 3" x3 3/4" x½"	75	3.0	15	0.84	+	0.084	-	0.026
white enriched (some milk)	1 slice, 4" x3 3/4 x½	60	2.0	11	0.40	+	0.056	-	0.016

[illegible]

[illegible]

[illegible]

CEREALS: Whole, Processed, Enriched

"ENRICHMENT", History of:

How to Use Bread in Modern Meals, Zinsmaster Baking Co., 1942, (our files C-221); page 4: "Enriched white bread was first produced in 1941, at the behest of the Food and Nutrition Committee of the National Research Council. To insure uniformity of enrichment of white bread, the U.S. Food and Drug Administration has indicated legal, official daily requirements for most of the vitamins and minerals contained in it."

Nutrition Reviews, The Nutrition Foundation, Inc., Chrysler Bldg., N.Y.C., 2, Dec. 1942, page 61; "At present the governmental authorities in England have authorized (1) the production of a "national wheat meal" of 85% extraction, fortified with calcium carbonate, and (2) the addition of thiamine to white flour. It would be inadvisable however, for the reasons given, to apply the conclusions of the British investigators to conditions elsewhere, or to accept the conclusions with out reservation."

Journal of the American Dietetic Association, April 1942,(Vol. 18, No. 4), "Why Enriched Bread?", by Williams and Wilder: "In contrast to the poor acceptance by consumers of whole wheat bread, our investigation shows that about forty percent of all the family flour on the market and more than a third of all baker's bread has been enriched. We owe this fine achievement mainly to the millers and the bakers, who have gone ahead with little help thus to improve the nutritive quality of white bread. They have done this in the interest of the public health. They began to make enriched bread and flour in February 1941, at the time of a pronouncement on the subject by the Committee on Food and Nutrition of the National Research Council. The committee is a body of scientists and physicians serving as advisers to the government in the national emergency.

"But forty percent of all the flour and a third of all white bread is not enough to have enriched. The low-priced flours on the market are not enriched, and it is these flours that are eaten by people whose diets most need improving. All flour and all white baker's bread should be enriched."

Bakers Weekly, American Trade Publishing Co., N.Y.C., September,6, 1943, "The Importance of Bakery Products in the War Food Program", by Robert H. Black, Assistant Chief, Grain Products Branch, Food Distribution Administration: "Bakers at the present time are making their enriched bread by the addition of tablets, by the use of enriched yeast, and also by the use of enriched flour. It is expected that on October 1 the higher level of enrichment required by the regulation under the Food, Drug and Cosmetic Act will be effective.

"On July 21 a public conference was held in Washington to determine the best means of securing a wider distribution of enriched bakery products, including those made in the homes and in hotels, restaurants, and institutions as well as those made by commercial bakers. Persons unable to attend the conference were invited to write us regarding their opinions. So many letters, telegrams, and briefs were filed in response to our invitation that we were unable to complete the digest of this information until last week. The information is now being studied

CEREALS: Whole, Processed, Enriched

"Enrichment", History of:

Bakers Weekly (continued)

to determine what method or combination of methods will accomplish the objective. We believe that the bakers deserve an early decision, and it is hoped that a decision can be reached some time in September."

Federal Register, July 3, 1943, page 9116: It states that enriched flour of the future is to have the following percentages of added ingredients, or if not that other percentages must be given on the label:

	Units added per Pound of Flour	
	Minimum	Maximum
Thiamin	2.0 mgs	2.5 mgs
Riboflavin	1.2 mgs	1.5 mgs
Niacin	.16. mgs	.20. mgs
Iron	.13. mgs	.16.5 mgs
Calcium	.500. mgs	625. mgs
Vit. D	250. USP	1,000. USP

"The regulations hereby promulgated shall become effective on the ninetieth day following the date of publication of this order in the FEDERAL REGISTER. Dated: July 1, 1943.

Watson B. Miller
Acting Administrator
Food and Drug Administration"

Food Field Reporter, October 16, 1943, page 23; "Marx Assails Compulsory Bread Enrichment", Milwaukee: "The compulsory enrichment of bread was declared to be an invasion of American democratic principles in an address by Victor E. Marx, in charge of the bakery division of the American Milk Institute, before the recent annual convention of the Wisconsin Bakers Association. While approving the bakers' almost unanimous opposition to the recent government proposal which would have made the use of enriched flour the only acceptable method of enrichment, Mr. Marx felt the bakers had not gone quite far enough.

"Peculiarly, in the thinking of bakers, "MR. Marx stated, "while they saw in this proposal a threat to their democratic freedom to choose their own method of enrichment, they did not see in the compulsory enrichment of all white bread the loss of freedom of choice of the consumer for the kind of bread she desires."

"In the opinion of Mr. Marx, compulsory enrichment is unsound, because "the proof of great superiority of enriched bread is very difficult to find." For example, he claimed, "it can be clearly shown, by scientific feeding tests on experimental animals that unenriched bread containing 6 percent of non-fat-milk solids will support growth far better than enriched bread not containing milk."

CEREALS: Whole, Processed, Enriched

"ENRICHED" DEFINED, Flour Enrichment vs. Bread Enrichment

Sherman, H. C., and Caroline S. Lanford, Essentials of Nutrition, MacMillan Company, N.Y.C., 1943, page 209: " 'Enriched' is the term authorized by the United States Food and Drug Administration to designate a white or near-white flour or bread which contains specified amounts of thiamin (and of such other things as may be prescribed by Federal regulation) whether this enrichment be effected by one or another of the three plans just mentioned* or by combining them with each other or with new methods of milling which produce white or near-white flours of the ordinary roller-mill process."

Wilder, Russell M., Chief, Civilian Food Requirements Branch, F.D.A., War Food Administration, Washington, D. C., July 21, 1943: Concerning enrichment of bread versus enrichment of all white family flour, he said: "However I feel strongly that the second procedure** is basically the sounder." "The number of bakers is so large, roughly 30,000 many of them small, that the problem of obtaining full cooperation is extremely difficult." "Thus the practical advantages of enriching all flour flour are very great."

Cooper, Barber, and Mitchell, Nutrition in Health and Disease, J. B. Lippincott, Philadelphia, 1941, page 500: " 'Enriched' bread may be made from "enriched" flour or by the use of special yeasts; by the addition of vitamin concentrates or by a combination of these methods. The standard for vitamin and mineral content of the bread is about two-thirds that of the flour to allow for losses in cooking and for the fact that bread is not all flour."

Nutrition Division of the Office of the Federal Coordinator of Health, Welfare, and Related Defence Activities, 20 Questions on Enriched Flour and Bread, 1941: "1. What is enriched flour? White flour plus thiamin, nicotinic acid, and iron."

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*Sherman, ibid: "The replacement of the thiamin, so as to bring white bread to something approaching a whole-wheat level in this respect, can now be done in any of three ways: by returning wheat germ in the making of the bread; by the use of a specially developed high-vitamin yeast; by adding pure thiamin to the white flour when milled."

**Meaning that of enriching all white family flour.

CEREALS: Whole, Processed, Enriched

"ENRICHED" DEFINED, Flour Enrichment vs. Bread Enrichment

Transcript of Discussion on "Enriched" Bread and Flour, held at the National Federation of American Bakers and Millers Conference which met in Chicago, Ill., March 5, 1941; Consumers Section, page 12, Miss Gladys Hall, Educational Director of the American Dietetic Association: "Of course, our first concern is to provide an adequate diet for all groups in some way. The enriched bread undoubtedly will help many groups but there certainly is the question of the Southerners' eating habits. We are inclined to think of the Southerners' diet in terms of cornbread, perhaps. On the other hand, they do consume large quantities of biscuits and that type of thing.

Bakers Weekly, American Trade Publishing Company, N.Y.C., September 6, 1943, "The Importance of Bakery Products in the War Food Program", by Robert H. Black, Assistant Chief, Grain Products Branch, Food Distribution Administration, page 34: "Bakers at the present time are making their enriched bread by the addition of tablets, by the use of enriched yeast, and also by the use of enriched flour. It is expected that on October 1 the higher level of enrichment required by the regulations under the Food, Drug and Cosmetic Act will be effective."

The Journal of Nutrition, June 10, 1943, "The Contribution of Non-Fat Milk Solids to the Nutritive Value of Wheat Breads", by Mitchell, Hamilton, and Shields, page 601: "The incorporation of non-fat milk solids in white bread to the extent of 6% of the flour improves the growth-promoting and bone calcifying values of the bread much more than does its enrichment with thiamine, nicotinic acid and iron. The "Enrichment" of white bread containing skim milk solids does not further improve its capacity of promoting growth, but it does, if only slightly, induce a greater concentration of hemoglobin in the blood."

[illegible]: [illegible]

"[illegible]", Flour Enrichment vs. Bread Enrichment

Transcript of discussion on "Enriched" Bread and Flour, held at the [illegible] Association of American [illegible] and Millers Conference [illegible] Chicago, Ill., March 2, 1943. Conference Section: [illegible] Chairman, Nutritional Director of the American [illegible] Institute: "Of course, our first concern is to provide [illegible] for all people in some way. The nutritional [illegible] adequate diet for all people in some way. The nutritional [illegible] will help more people but there certainly is the [illegible] of the Government's setting benefits. We are inclined to [illegible] the Government diet in terms of compared, variance. On [illegible] hand, they do come in varying quantities or amounts and [illegible] type of diet."

Sidney [illegible], Director Trade Relations Department, [illegible], September 6, 1943, "The Importance of Bakery Products in the New Food Program", by [illegible] Director, Nutritional Food Products Branch, Food [illegible], Nutritional Food, Grain Products Branch, Food [illegible] Administration, says Mr. "Where at the present time [illegible] and making their enriched bread by the addition of tablets, by the use of enriched yeast, and also by the use of enriched flour. It is expected that [illegible] number in the higher level of enrichment required by the regulations under the Food, Drug and Cosmetic Act [illegible] effective."

The Journal of Nutrition, June 10, 1943, "The Contribution of Non-fat Milk Solids to the Nutritive Value of Wheat Breads", by Mitchell, [illegible], and Dialds, says (p.1): "The incorporation of non-fat [illegible] solids in white bread to the extent of 6% of the flour improves [illegible] and thus satisfying values of the bread much [illegible] and thiamine, niacinamide and [illegible] the "Enrichment" of white bread containing skim milk solids [illegible] of further improve its capacity of promoting growth, but it does, if only slightly, induce a greater concentration of hemoglobin in the blood."

CEREALS: Whole, Processed, Enriched

WHOLE GRAIN FLOUR, Pro and Con:
Amount of Milling Most Desirable:

Transcript of Discussion on "Enriched" Bread held by American Bakers and Millers in Chicago, Ill., March 5, 1941, page 11; Dr. Toby, Dir., Dept. of Nutrition, American Inst. of Baking: "If your bread is enriched it contains thiamin, Nicotinic acid and riboflavin, you have the essentials from the nutritional point of view. You don't need to think about pantothenic acid, pyridoxine, and perhaps some other slightly known components of the B complex."

Report by the Food Research Laboratories, Inc., 114 E. 32 St., N.Y.C., 1941, Table III:

"LABORATORY TESTS TO DETERMINE THIAMINE LOSS DURING BAKING

Air Dried Samples	Thiamine Content I. U. Per Lb.		Thiamine Destroyed by Baking, percent
Basal bread	113		26
Enriched bread	465	with yeast	13
Enriched bread	381		21
Enriched bread	423	with mg.tablet	9
Enriched bread	353		18
Whole wheat bread	656		6 "

Journal of the American Dietetic Association, April, 1942, "Why Enriched Bread?" by Robert R. Williams and Russell M. Wilder: "The Russian army is fed whole grain. Thus far it is the only army to match successfully the whole-grain eating army of the Nazis. The endurance of the Russian citizen equals the vigor of the Russian soldier. The Russian people eating whole-grain bread receive important nutrients denied to people who depend on ordinary white flour for their bread. . . . . "Most people simply cannot be persuaded to eat whole wheat. Because of the over-refinement of white flour, physicians for a hundred years have urged the use of whole wheat bread. In spite of the doctor's advice, in spite of similar teaching by nutritionists, people continue to refuse to eat the dark breads recommended. "Why? Some people think the millers and bakers are responsible. They say that people would eat whole wheat or undermilled dark bread and use whole wheat flour in their cooking if the millers and the bakers would provide such products. Nothing could be further from the truth. Whole or partly whole wheat breads can be bought in almost every bakery. The millers have every commercial reason for wishing to sell the whole of their grain as flour if they could do so. The bakers, we have learned, make whatever the public wants. Wheat farmers have a motive for promoting the continued use of white flour as nearly a third more wheat is required to make a barrel of white flour than one of whole wheat flour. However, it is not apparent that their voices have been influential in this matter. Repeated efforts have been made and millions of dollars have been spent by the milling and baking industries to popularize dark breads; all without success. We have investigated and found that almost every large baking concern has among its officers some man who has had his fingers burned in an

CEREALS: Whole, Processed, Enriched

Whole Grain Flour, Pro and Con:
Amount of Milling Most Desirable:

Journal of the American Dietetic Association (Continued)
attempt to promote the sale of whole wheat bread or like breads. Yet today less than two percent of all the flour sold is whole wheat flour. The widespread efforts to get people to eat more whole wheat bread have failed, because the public prefers the color, texture and flavor of white bread."

Nutrition Reviews, The Nutrition Foundation, Inc., Chrysler Bldg., N.Y.C., March 1943 (Vol.1, Number 5), page 132: "The experiment showed that 10.5 grams of the proteins of whole wheat were as useful to the rat as 13.1 grams of white flour proteins. Other arrangements of the data obtained, for example the calculation of the amount of protein in the food required for each gram of weight gained, showed that the biologic value of the proteins in whole wheat flour was superior to the biologic value of the proteins in white flour. ... "These investigators pointed out that the slight difference in digestibility favoring white flour is more than compensated for by the greater biologic value of the national wheat meal or by the whole wheat meal in the promotion of growth. ..... Further, the animals receiving whole wheat meal and national meal consumed more food than the animals receiving white flour."

Food Field Reporter, N.Y.C., Sept. 6, 1943, "Proteins of Whole Wheat Surpass White Flour", page 24: "The Biologic value of the proteins in whole wheat flour was found to be superior to that in white flour in studies done by Chick and reported in the English Journal "Lancet". His work was commented on in a recent issue of "Nutrition Reviews".

"Experiments showed that 10.5 grams of the proteins of whole wheat were as useful to the rat as 13.1 grams of white flour proteins.

"In two experiments it was found that 87.9 and 86.8 percent of the protein in white flour was digested and absorbed as compared to 85.4 and 86.6 in national wheat meal (an officially approved high extraction flour) and 83.2 and 81.7 in whole wheat meal. This investigation pointed out that the slight difference in digestibility favoring white flour is more than compensated for by the greater biologic value of the national wheat meal or by the whole wheat meal in the promotion of growth."

APPENDIX: Whole, Processed, Enriched

Whole Grain Flour, Bran and Germ:
Amount of Milling Just Satisfactory:

Journal of the American Dietetic Association (Continued)

attempt to provide the role of whole wheat bread or life breads. Can today less than two percent of all the flour sold is whole wheat flour. The widespread efforts to get people to eat more whole wheat breads have failed, because the public prefers the color, texture and flavor of white bread."

Nutrition Review, The Nutrition Foundation, Inc., Director Bliss, N.Y.C., March 1942 (Vol.1, Number 5), page 132: "Experiment showed that 70.6 grams of the proteins of whole wheat were as useful to the rat as 72.1 grams of white flour proteins. Other arrangements of the data obtained, for example the calculation of the amount of protein in the food required for each gram of weight gained, showed that the biologic value of the proteins in whole wheat flour was superior to the biologic value of the proteins in white flour. ... "These investigators point out that the slight difference in digestibility favoring white flour is more than compensated for by the greater biologic value of the endosperm wheat meal or by the whole wheat meal in the promotion of growth. ..... Further, the animals receiving whole wheat meal and enriched meal consumed more food than the animals receiving white flour."

Food Field Reporter, F.F.R., Sept. 6, 1943, "Proteins of Whole Wheat Compared with White Flour", page 23: "The biologic value of the proteins in whole wheat flour was found to be superior to that in white flour in studies done by Mitch and reported in the English Journal "Nature". The work was summarized on in a recent issue of "Nutrition Reviews".

Apparently is stated that 70.6 grams of the proteins of whole wheat were as useful to the rat as 72.1 grams of white flour proteins.

In two experiments, it was found that 77.3 and 86.8 percent of the protein in white flour was digested and absorbed as compared to 72.1 and 70.6 in pulverized wheat meal (an officially approved high extraction flour) and 72.6 and 81.7 in whole wheat meal. This demonstrates quite clearly that the slight difference in digestibility favoring white flour is more than compensated for by the greater biologic value of the endosperm wheat meal or by the whole wheat meal in the promotion of growth."

CEREALS: Whole, Processed, Enriched

WHOLE GRAIN FLOURS, Pro and Con:
Amount of Milling Most Desirable:

Sherman, H. C., and Caroline S. Lanford, Essentials of Nutrition, MacMillan Company, N.Y.C., 1943, page 226: "Whole wheat contains only about one-fourth as much riboflavin as thiamin. The germ or embryo is richer in both of these factors than is the entire grain. But asthe germ constitutes only about two percent of the weight of the grain a large fraction of both thiamin and riboflavin of wheat is rejected with the bran, even if the germ is retained with (or returned to) the white flour."
page. 355: "To provide more fully for thiamin (vitamin B_1) and iron, we have recommended also that of such amount of breadstuffs or cereals as one may choose to eat, at least half should be in the approximately "whole grain" forms; and we now add, "let all white bread be enriched"."

Williams, Robert R., and Tom D. Spies, Vitamin B_1 and Its Use in Medicine, MacMillian Co., N.Y.C., 1938, page 232: "In flour of 60% extraction, Schoenert found no thiamin; flour of 75% extraction retained 40% of that of the whole grain; of 82% extraction, 60% of that of whole grain. This method was again the rat protective one."

Sherman, H. C., and Constance, S. Pearson, Modern Bread, MacMillan Co.,N.Y.C., (389.1 Sh5M) page 41: "Rose and Vahlteich (1932) found the iron of whole wheat and of bran, as also of oatmeal, to be effective in hemoglobin formation. Patent flour also fostered hemoglobin to some extent; but patent flour with added iron was not so effective as the same total amount of iron in the form of whole wheat. They concluded that either the iron in oatmeal and whole wheat is more effective than that of white flour enriched with iron, or that the whole-grain products contain something else as well as iron which is favorable to the assimilation of iron and the formation of hemoglobin."

Annual Review of Biochemistry, Stanford University, 1943, (381 An7 vol.12), page 239: "Widdowson and McCance found that iron was well absorbed from a diet in which white flour bread constituted 40 to 50 percent of the calories. Iron was less efficiently absorbed, however, from similar diets when the white flour was replaced with a flour of 92% extraction." from: Widdowson, E. M., and McCance, R. A., Lancet, 1, 588-90 (1942)

Nutrition Reviews, The Nutr. Foundations, Inc., Chrysler, Bldg., N.Y.C., 5, March 1943, page 131: "Two reports show conclusively that whole wheat flour is digested almost as completely as white flour , and that its proteins are of higher biologic value. There is thus no objection and some advantage in the substitution of whole wheat flour for white flour, but other considerations lead to the conclusion that such a step by itself will not solve the problem of maintaining the general protein content of the diet."

CEREALS: Whole, Processed, Enriched

WHOLE GRAIN FLOURS, Pro and Con
Amount of Milling Most Desirable:

Wilder, Russell M., Chief, Civilian Food Requirements Branch, F.D.A., War Food Adm., Washington, D. C., July 21, 1943: "For the reasons given, extensive use of whole-grain and under-milled flours or of mixtures of white flour with legumes is judged undesirable as a means of correcting the inadequate supply of thiamine, niacin, and iron when the flour used is plain white flour." He states that the objections are: 1. Under-milling of flour will encounter consumer resistance which may result in lowering the intake of calories.
2. "A second objection to large-scale use of whole-wheat or under-milled flour is that such practice would divert the mill streams containing the bran coats of the wheat now going to animal feed, and diversion of this very important part of the supply of animal feed would result in undesirable curtailing of present meat and milk production. Feeds for livestock are in short supply." 3. "A third objection is that the keeping qualities of whole-grain flours and under-milled flours are poor as compared with white flour with resulting deterioration in hot climates such as prevail in the U.S. in the summer seasons." 4. "Finally, for a definite proportion of the population including many persons who are invalides, flours containing much bran or other roughage are sufficiently irritating to the bowles to be unacceptable."

Nutrition Division of the Office of the Federal Coordinator of Health, Welfare, and Related Defence Activities, 20 Questions on Enriched Flour and Bread, 1941, "10. Should enriched bread be used in place of whole wheat? No. If you prefer white bread be sure it is enriched."

Sherman, Henry C., and Pearson, Constance S., Modern Bread, MacMillan Co., N.Y.C., 1942, (389.1, Sh5M), page 50: "According to a report in the Lancet for August 3, 1940, the joint committee of the Lister Institute and the Medical Research Council recommended: (1) that wheat be milled to yield not less than 80 to 85 percent of its weight as flour." Pages 48-49: "And as the ordinary milling process of recent decades has excluded about four-fifths to nine-tenths of the thiamin of wheat from the bread flour, thiamin has been the nutrient first and most prominently considered in recent movements to enrich white flour and bread. Copping (1939) concludes that whole wheat contains an average of 5.58 micrograms of thiamin per gram, and correspondingly . . . . . flour of 82% extraction, 3.00, and . . . . of 60% extraction, 0.72 micrograms per gram. This would mean only about one-fifth as much thiamin in straight-run flour and only about one-eight as much in patent flour as in whole wheat. On the other hand, when wheat is so milled that 82 to 95 percent or more of the weight of the grain is recovered as bread flour, such a flour can be free from harsh fiber and can be capable of yielding a strong dough and a bread of light texture, while at the same time it may contain the greater part of the thiamin of the grain and at least four times as much thiamin as is contained in the patent and other low-extraction flours chiefly used for breadmaking during the past two decades.

CEREALS: Whole, Processed, Enriched

WHOLE GRAIN FLOURS, Pro and Con:
Amount of Milling Most Desirable:

Nutrition Reviews, The Nutrition Foundation, Inc., Chrysler Bldg., N.Y.C., Nov., 1942, 1, page 11: "Fifty samples of milled patent and clear flours indicate that the milling loss of niacin, pantothenic acid, and pyridoxine is approximately 83, 57, and 52 percent respectively for patent flour and 64, 28, and 15 percent respectively for the first clear flour.

. . . "Thus we know that thiamine, riboflavin, and pyridoxine are concentrated in the germ portion of the wheat but niacin and pantothenic acid are not. The addition of small amounts of the germ to flour would not be an effective means of raising the concentration of the latter two vitamins in flour or bread, and it would appear that the nutritional improvement given to bread by including 5 percent of germ cannot be attributed to the addition of these two members of the B-complex." from study by Tepy, Strong, and Elvehjem (Journal of Nutrition 24, 167 (1942))

Discussion on "Enriched" Bread held by American Bakers and Millers in Chicago, Ill., March 5, 1941 (transcript of), page 5; Dr. Wilder: "The Ministry of Foods yesterday announced arrangements with millers and bakers for immediate production of whole meal flour and bread, 85% extraction, in quantity sufficient to meet all demands and at the same price as white bread. Eight-five percent extraction selected as maximum digestibility and nutriment."

page 14; Dr. J. A. Tobey, Director, Dept. of Nutrition, American Institute of Baking: "Mr. Williams, Dr. Skovholt asks if it is possible and if it is proper to designate the minimum levels of Enriched Bread as meeting the whole wheat level or standard. I don't think it is and I believe that Dr. Baily agrees with me. We hope perhaps to be able to set forth what seems to be the consensus of opinion of the levels in whole wheat, at least within low and high levels of the whole wheat bread, so many milligrams of iron, etc., so that you can see from that whether the standard you have in your bread is approximately equal to whole wheat or whether it isn't, whether it is below it or whether it is above it. It is a rather difficult thing to set. However, we will try to doso."

consumer's section, page 2; Dr. Helen Mitchell, Nutr. Consultant to the Coordinator on Health Problems: "Another thing that Mrs. Consumer is worried about is the question as to whether this new bread it to replace whole wheat bread which her family happens to have liked. Now, we allknow that it is a very small percentage of our total consuming population that uses whole wheat products. Some of our nutrition people have been trying to persuade them to do that for a long time but it is the 98 percent who have not been using those whole wheat products for whom this program is primarily aimed. But it is the vociferous and audible 2 percent who are concerned as to how it is going to affect the users of whole wheat. I think we can give them some comments that will ease their minds."

CEREALS: Whole, Processed, Enriched

WHOLE GRAIN FLOURS, Pro and con:
Amount of Milling Most Desirable:

The Journal of Nutrition, June 10, 1943, "The Concentration of Non-Fat Milk Solids to the Nutritive Value of Wheat Breads", by Mitchell, Hamilton, and Shields (Univ. of Ill.), page 601: "For the purposes of growth, skim milk solids is a better supplement to white flour than the residue of the wheat berry discarded in its milling, though a combination of the two supplements is better than either alone. There is something in whole wheat, as compared with patent white, flour that impairs calcium utilization. Enriched white bread with skim milk solids is the equal of whole wheat bread in the promotion of growth and in the production of blood hemoglobin and is distinctly superior to it in the promotion of bone calcification."

Cereal Chemistry, May, 1943, Vol.XX, No.3, page 329, "The Manganese Content of Bread and Wheat Products", by Hoffman and Dalby of Ward Baking Co., N.Y.C.,: "Manganese and ash are closely related factors. A manganese determination on enriched bread is often useful in judging the type and grade of flour used in its manufacture. Whole wheat flours average 35-40 micrograms of manganese per gram, whereas standard patent flours average about 4 micrograms per gram."

The Journal of Nutrition, October 11, 1943 (389.8, J82), "Some Results of Feeding Rats a Human Diet Low in Thiamine and Riboflavin", by Higgins, Mason and Gatz (Mayo Foundation), page 347: "Five diets differing from one another only in the flours from which the bread component was made, were prepared. Supplementations of patent white flour with thiamine, riboflavin and niacin, while improving the growth rate of the rats, were not adequate to secure weights attained by animals eating the diet that contained whole wheat flour. . . . Fortification of the flour used in the bread component of the low thiamine-low riboflavin human diets with thiamine, riboflavin and niacin in the amounts proved inadequate to promote satisfactory growth or to prevent pathologic changes in the livers, thyroids and pituitary glands of white rats."

[illegible] : Whole, Processed, Enriched

WHOLE GRAIN FLOURS, fire and corn:
Impact of "Milling Just Bearable:

The journal of Nutrition, June 10, 1943, "The Supplementation of Non-Fat Diets Rich in the Antihemorrhagic Value of Wheat Germs", by Mitchell, Hamilton, and Wilgus (Univ. of Ill.), says only: "For the purposes of growth, white milk solids is a better supplement to white flour than the residue of the wheat germ discarded in the milling, thus a combination of the two supplements is better than either alone. There is something in whole wheat, as compared with refined white flour that imparts calcium utilization. Enriched white bread with white milk solids is the equal of whole wheat bread in the promotion of growth and in the production of blood hemoglobin and is distinctly superior to it in the promotion of bone calcification."

Cereal Chemistry, May 1943, vol.XX, No.3, page 270, "The Dangerous Content of Fresh and Wheat Products", by Hoffman and Daily of Iowa Pathologists, ...: "Dangerous and are closely related factors. A thorough determination on enriched bread is often useful in judging the type and grade of flour used in the manufacture. Whole wheat flours average 3[illegible] milligrams of riboflavin per gram, whereas standard patent flours average about 1 milligram per gram."

The Journal of Nutrition, October 11, 1943 (Vol.6, 1[illegible]), "Some Results of Feeding Diets Low in Thiamine and Riboflavin", by [illegible], Jones and Cole (Iowa Foundation), page 3[illegible]: "Diets differing from one another only in the flour which the bread component was made, were prepared. Supplementations of patent white flour with thiamine, riboflavin and niacin, while improving the growth rate of the rats, were not adequate to secure weights attained by animals eating the diet that contained whole wheat flour. . . . . Fortification of the flour used in the bread component of the low thiamine-low riboflavin bread diets with thiamine, riboflavin and niacin in the amounts proved insufficient to produce satisfactory growth or to prevent pathologic changes in the liver, kidneys and vitreous glands of white rats."

CEREALS: Whole, Processed, Enriched

"ENRICHMENT", Nutritional Need for:

Annual Review of Biochemistry, Stanford University Press, Vol.12, 1943 (381 An7 V.12), page 324: "Studies of the thiamin content of the average American diet have revealed that before the advent of enriched bread it contained about 0.8 mg. per 2500 cal. Enrichment of all flour and bread would raise this value to 1.3 mg. Lean pork, bread, and milk are the principal contributors of thiamin to the diet." From: Lane, R. L., Johnson, E., and Williams, R. R., Journal of Nutrition 23, "613-24" (1942).
"One the basis of extended studies on induced thiamin deficiency in human beings, the minimal requirement is set at 0.55 mg. per 2500 cal. and for maintenance of efficiency 1.25 to 1.5 mg." From: Williams, R. D., Mason, H. L., Smith, B. F., and Wilder, R. M., Arch, Internal Med., 69, 721-38 (1942).

Nutrition Reviews, The Nutrition Foundation, Inc., Chrysler Building, N.Y.C., April, 1943, 6 page 175: "Intestinal organisms isolated from man have been shown to synthesize thiamine, riboflavin, niacin,, and biotin (Nutrition Reviews 1, 4 (1942))."

Nutrition Reviews, The Nutrition Foundation, Inc., Chrysler Bldg., N.Y.C., Dec. 1942, 2, page 59: "Yet nutritionists long have pointed out the superior nutritive value of whole wheat as compared to its milling products, particularly patent flour. According to reports in the literature, average whole wheat flour--from hard winter wheat--provides in each 100 g. about 0.45 mg. of thiamine, 0.25 mg. of riboflavin, 6.0 mg. of nicotinic acid, 53 mg. of calcium, and 3.9 mg. of iron. An equal amount of white flour on the other hand provides about 0.05 mg. of thiamine. 0.04 mg. of riboflavin 0.8 mg. of nicotinic acid, 16 mg. of calcium, and 1.0 mg. of iron."

Sherman, H. C., and Constance S. Pearson, Modern Bread, MacMillan Co., 1942, (389.1 Sh5M), page 45: "Stone-ground wheat flour "of our grandparents" is estimated to have contained about 60 percent of the thiamin in the wheat. In contrast, the white flour produced by the roller process is reported to contain only 6 to 16 percent. No longer are we justified in ignoring this difference on the assumption that, in the diversified diets of this country, enough thiamin will always be supplied from other sources."

The Journal of Nutrition, October 11, 1943 (389.8, J82), "Studies of the Average American Diet", by Cheldelin and Williams (Univ. of Texas), page 417: "The riboflavin, nicotinic acid and pantothenic acid contents of the average American diet, such as was consumed by the middle two-thirds or three-fourths of the population prior to the use of enriched bread and flour, are approximately 1.4 mg., 11 mg, and 4.9 mg., respectively, per 2500 calories. These values are appreciably lower than the most generally supposed daily requirements. . . Enrichment of bread and flour to meet prevailing standards increases the level of riboflavin, 12% to 1.6 mg.; that of nicotinic acid, 53% to 17 mg. The principal contributors of these vitamins to ordinary diets are as follows in the order of their importance: for riboflavin, milk, white bread, eggs, potatoes and liver; for nicotinic acid, beef, lean pork, fish, white bread and potatoes; for pantothenic acid, white bread, milk, eggs, and potatoes."

"[illegible], Nutritional Need for:

[illegible] Service of Pennsylvania, Standard University Press, Vol. 10, 1943 [illegible] Nutrition of the Nation contents of the [illegible] (Vol. 1.12), page 320: "Studies of the Nation contents of the [illegible] Americans diet were revealed that before the advent of [illegible] 0.4 mg. per 2000 cal. [illegible] [illegible] proved to contained about 0.5 mg. [illegible] [illegible] white bread would raise this value to 1.5 mg. [illegible] 2 lb. flour and white bread would [illegible] [illegible] milk are the nutritional contributors of thiamin [illegible] Jones, R. L. Jones, [illegible] and Williams, T. [illegible] [illegible] Jones, R. L. Jones, [illegible] (1942).

[illegible] Nutrition 23: "Studies on [illegible] thiamin deficiency in [illegible] of [illegible] studies [illegible] 0.55 mg. per 2000 [illegible] [illegible] from [illegible] to [illegible] 1.5 mg. [illegible] [illegible] Williams, T. [illegible] [illegible] Jones, R. L. Jones, [illegible] (1942).

[illegible] Nutrition Abstracts, Inc.: "Chrysler Building, [illegible] [illegible] April, 1942, 6 pages 1935: "Nutritional consultants [illegible] [illegible] (1942)."

[illegible] Nutrition Institute, Inc.: Chrysler Bldg., N.Y.C.: [illegible] Nutrition Institute consultants have pointed out the [illegible] 2, June 29: "Yet vitamin-rich meals do depend to the vitamin [illegible] vitamin value of whole wheat as reported in the [illegible] particularly wheat flour. According to reports in the [illegible] average whole wheat flour--from hard winter wheat--[illegible] 0.2 mg. of thiamine, 0.2 mg. of [illegible] 100 g. enough 0.15 mg. of [illegible] and 2.2 [illegible] of riboflavin and 52 mg. of niacin, on the other hand provide [illegible] flour on the other hand provide [illegible] equal amount of [illegible] riboflavin 0.8 mg. of niacin [illegible] 0.04 mg. of thiamine. [illegible] of iron, [illegible] of calcium and 2.2 [illegible] Leading Bread, Bakeries Co., 1942, [illegible] Issues 5: "Stone-ground wheat flour of our grandmothers [illegible] 1 [illegible] issue 15: "Stone-ground wheat flour is the thiamin in the [illegible] have contained about 1/2 percent of the thiamin in the [illegible] contained only 5 to 10 percent. To longer are we justified [illegible] in contrast, the white flour produced by the roller process [illegible] to contain [illegible] differences on the production that [illegible] in [illegible] country, a bowl bakeries will always be [illegible] from other bakery associations."

[illegible] Chapter 12, page (pp. 6, 7), "Studies of the [illegible] Nutritional Status" by Bailey and Williams (Univ. of Texas), [illegible] 1: "The riboflavin, niacin and ascorbic acid content of the [illegible] Nutritional Status that, most [illegible] examined by the middle [illegible] to the use of airplanes or [illegible] of the production of [illegible] 0.4 mg. and 1.2 mg. [illegible] Bread and flour are [illegible] values are appreciably lower [illegible] good relation [illegible] Breakfast [illegible] nutritionally important [illegible] 2.5 mg. [illegible] than the most nutritious [illegible] increase the level to [illegible] 2.5 to 17 mg. [illegible] to 1.5 mg. that of riboflavin acid, 2.5 to 17 mg. [illegible] 1.5 mg. [illegible] of these vitamins to ordinary diets are [illegible] nutritional contributors of these vitamins to ordinary diets are [illegible] 1 r riboflavin, milk, [illegible] follows the order of their importance, meat, beer, poor [illegible] potatoes and lettuce; for the thiamin acid, white bread, [illegible] bread and potatoes; for pantothenic acid, white bread, [illegible] milk, eggs, and potatoes."

CEREALS: Whole, Processed, Enriched

"ENRICHMENT", Nutritional Need for:

Wilder, Russell M., Chief, Civilian Food Requirements Branch, F.D.A., War Food Administration, Washington, D. C., July 21, 1943: "Wheat for several years has contributed approximately one-fourth of the calories of the average diet of the civilian population of the United States." "White flour constitutes more than 95% of the milled wheat products used in the human diet." "White flour is deprived, by the nature of its manufacture, of from 80 to 90 percent of the micro-nutrients thiamine, niacin, and iron contained in the wheat from which it is made."

Wilder, Russell M., Jan., 1943, Vitamin B_1 (Thiamine), Annals of the American Academy of Political and Social Science, 225, (280.9 Am34), page 29: "White patent flour retains little more than a tenth of the thiamine in wheat; and bread makes up a sizable fraction of the average diet." "Basing calculations on the disappearance of food products of human consumption in the United States, Lane and co-workers* conclude that the total provision of thiamine does not exceed an average of 0.32 mg. per 1,000 calories. This figure equals that defined by the United States Food and Drug Administration as the minimal dialy adult requirement necessary to prevent actual disease. The minimal daily requirement to prevent biochemical abnormality, as determined by Williams and co-workers, is 0.45 mg. per 1,000 calories. The allowance recommended by the Food and Nutrition Board of the National Research Council is 0.6 mg per 1,000 calories. If the average person receives only 0.32 mg. per 1,000 calories, it should be obvious that millions of our population are suffering from actual deficiency disease and that relatively few diets provide enough thiamine for full health and efficiency."

Batchelder, Esther L., Jan. 1943, Riboflavin, Annals of the American Academy of Political and Social Science, 225, (280.9 Am.34), page 32: "Reports of widespread occurance of riboflavin deficiency disease, diagnosed by qualified observers, indicates that the diet of many Americans is too low in this factor. Milk, liver, kidney, and eggs are generally recognized as dependable sources of this factor. Whole-grain cereals are not very rich on a weight basis, but if used instead of refined products, can appreciably increase the intake of this vitamin."

Elvehjem, C.C., Jan., 1943, "The Newer Members of Vitamin B Complex," Annals of the American Academy of Political and Social Science, 225, (280.9 Am34) page 35: "Meat, milk, vegetables, and cereals are all good sources of pyridoxine and pantothenic acid, and less than one-half of the original amount of these factors present in the whole cereals is lost during milling, in contrast to a loss of 90 percent for thiamine and niacin."

*R.L.Lane, Elizabeth Johnson, and R.R.Williams, "Studies of the Average American Diet. I. Thiamine Content", Journal of Nutrition, 23: 613-24, June 1943.

[illegible] Nutritional Food Fact:

[illegible] "Chief, Division Food Conservation Program, F.D.A., [illegible] Administration, Washington, D. C., July 21, 1943: "Wheat for several years has constituted approximately one-fourth of the calories of the average diet of the civilian population [illegible] United States." "Wheat flour constitutes more than [illegible] of the million short tons used in this human diet." "While flour is derived, by the nature of its manufacture, of from 60 to 90 percent of the nutrients [illegible], vitamin, and in [illegible] in the wheat from which it is made."

Miller, Russell T., Ibid., 1943, Vitamin B1 (Thiamin): Amounts of the [illegible] Academy of Political and Social Science, 225: (229-9 Ap.44) [illegible] "While cereal flour relative [illegible] more than a tenth of the diet in wheat, and bread rules up a stable fraction of the average diet." "Based calculations on the disappearance [illegible] of food crops in consumption in the United States, Iowa and co-workers conclude that the total production of thiamine does not exceed an average of 0.25 mg. per 1,000 calories. This figure equals that defined by the United States Food and Drug Administration as the minimal daily adult requirement necessary to prevent actual diseases. The minimal daily requirement to prevent biochemical inadequacies, as determined by Williams and associates, is 0.5 mg. per 1,000 calories. The allowance recommended by the Food and Nutrition Board of the National Research Council is 0.5 mg per 1,000 calories. If the average person receives only 0.25 mg. per 1,000 calories, it would be obvious that millions of our population are suffering from actual deficiency diseases and that relatively few diets provide enough thiamine for full health and efficiency."

Rathbun, Esther L., Ibid., 1943, Nutritional Anemia of the American Academy of Political and Social Science, 225: (229-9 Ap.44), page 32: "Anemia is a widespread consequence of nutritional deficiency diseases, illustrated by qualified observers, indicates that the diet of many American is too low in this factor. Milk, liver, kidney, and eggs are essentially recognized as dependable sources of this factor. Iron - rich cereals are not very rich on a weight basis, but used instead of refined products, can appreciably increase the intake of this vitamin."

Wheldon, T. A., Ibid., 1943, "Is Lower Anemia of Vitamin B Complex," Annals of the American Academy of Political and Social Science, 225: (229-9 Ap.44) page 37: "Meat, milk, vegetables, and cereals are all good sources of pantothenic and para-aminobenzoic acid, and less than normal of the organical amount of these factors present in the whole cereals is that during milling, it contributes to a loss of 60 percent for thiamine and riboflavin."

[illegible], Elizabeth Hansen, and [illegible] Williams, "Studies of the Average American Diet. I. Thiamine Content", Journal of Nutrition, 27: 615-24, June 1944.

CEREALS: Whole, Processed, Enriched

ENRICHMENT OF FLOUR: How:

Wilder, Russell M., Chief, Civilian Food Requirements Branch, F.D.A., War Food Adm., Washington, D.C., July 21, 1943: "Provision of satisfactory quantities of thiamine, niacin, riboflavin, and iron by under-milling wheat or by additions to white flour of soybeans, cottonseed or other legumes, in the quantities necessary to provide the required amounts of these nutritional factors, yields flours that are less satisfactory for many purposes from the standpoint of cooking quality, appearance and taste. Such flours encounter consumer resistance. And if consumer preference for white flour is ignored, there is reason to expect that wheat will be consumed less freely with resulting lowering of the intake of calories. This would lead to loss of weight and loss of strength."

F.D.A., War Food Adm., Abstract of Proposed Food Distribution Order Requiring Enrichment of All White Family Flour, July 2, 1943: "1. Provisions: Except as hereinafter indicated, no miller, blender or other person who manufactures or prepares white flour for sale for human consumption may sell or deliver the same unless it conforms to the amended definition of "Enriched Flour" contained in the proposal under the Federal Food, Drug, and Cosmetic Act, published in the Federal Register of June 5, 1943, pages 7511 - 7514. ("The amended definition describes enriched white flour as containing in each pound not less than 2.0 milligrams of thiamine, 1.2 milligrams of riboflavin, 16 milligrams of niacin or niacine amide, and 13 milligrams of iron. Calcium and vitamin D remain optional ingredients as heretofore.)"

Federal Register, June 5, 1943, Food and Drug Administration, F.S.A., Enriched Flours and Farina, Amendments to Definitions and Standards of Identity. "II. The following are reasonable limits, expressed as milligrams per pound, for thiamine, niacin, and iron as required ingredients in enriched flour, enriched bromated flour, and enriched self-rising flour. Thiamine, 2.0 to 2.5; Niacin, 16.0 to 20.0; Iron, 13.0 to 16.5. A reasonable maximum limit for riboflavin as a required ingredient in enriched flour, enriched bromated flour, and enriched self-rising flour is 1.5 milligrams per pound. A reasonable maximum limit for calcium as an optional ingredient in enriched flour and enriched bromated flour is 625 milligrams per pound, and reasonable minimum and maximum limits for calcium as a required ingredient in enriched self- rising flour are, respectively, 500 and 1500 milligrams per pound.

Transcript of Discussion on "Enriched" Bread and Flour, held at the National Conference of American Bakers and Millers in Chicago, Ill., March 5, 1941; Dr. Bailey: "It is my understanding, although this should be checked by Counsel, that bread made with materials such as soy bean flour is not covered by the definition of "Enriched Bread", and therefore is somewhat outside of the general tenor of this particular conference. I assume that if such bread became sufficiently common, a special standard might be devised to fit the situation, but it is my opinion at the moment that the definition of "Enriched Bread" does not cover a mixture of flour and soy bean flour. I would be glad to have the council check that." (page 7)

CEREALS: Whole, Processed, Enriched

ENRICHMENT OF FLOUR, How:

Food Field Reporter, October 4, 1943, "Urge to Allow Soy in White Bread", page 24, Cedar Rapids, Iowa--"At the War Food Administration's request, the soybean industry has increased its soy flour producing capacity to 1,750,000,000 pounds. Now in view of the recent Food and Drug Administration's proposal to bar the use of soy flour (except up to one-half of 1% as a bleaching agent) in 'enriched white bread", the industry feels that at worst, it has been double-crossed, and that at best it is confused. Secretary George M. Strayer, Hudson, Ia., in his report to the recent American Soybean Association's war conference here said that the association will fight to change this view."

Food Field Reporter, October 18, 1943, page 32, "Bread Standards Would not Outlaw Soy Flour", Washington: "There is nothing in the recently proposed bread standards to outlaw the substantial use of soy flour in special bread formulas, W. G. Campbell, commissioner of foods and drugs, recently stated in a letter to George M. Strayer, secretary of the American Soybean Association. However, the administration felt that the addition of merely 3% of soy flour to bread--the highest percentage proposed by any witness at the bread hearing--would not be a significant nutritional contribution, it was explained.

MATERIAL: Wheat, Increased, Artificial

MISCELLANEOUS FOOD, Low:

Food Trade Journal, October 1, 1945, "Use of Flour Low in White Bread", page 20, Dodge Center, Iowa--"At the Iowa Administration's request, the soybean industry has increased its soy flour production capacity to 1,500,000 pounds. Now in view of the recent Food and Drug Administration's proposal to bar the use of soy flour instead of to go ahead with it as a fleshening agent in 'enriched white bread', the industry feels that it would, if has been worthless-wise, and that it best it is concerned. Secretary George W. Strayer, Pudor, Ia., in his report to the recent Soybean Soybean Association's war conference here said that the association will fight to change this view."

Food Trade Journal, October 18, 1945, page 28, "Bread Standards Would not Affect Soy Flour", Washington: "There is nothing in the recently proposed bread standards to outlaw the substantial use of soy flour in special bread formulas, W. G. Campbell, commissioner of foods and drugs, recently stated in a letter to George W. Strayer, secretary of the American Soybean Association. However, the association felt that the addition of nearly 2% of soy flour to bread--the highest percentage proposed by soy witness at the bread hearing--would not be a significant nutritional contribution, it was explained.

CEREALS: Whole, Processed, Enriched

"ENRICHMENT", Defraying Cost Of:

Transcript of Discussion, on "Enriched" Bread, held by American Bakers and Millers in Chicago, Ill., March 5, 1941, page 12; Mr. Harold West (Consumers Conference): "I think you might think, as consumers, which way you think would be the best way to bring that out for the masses, because those of us who want to help in this program, I believe, are thinking in terms of the masses, not in terms of the few. I personally do not expect that any baker will charge a premium for the enriched loaf. After all, it is only a question of 40 cents a barrel on flour and flour fluctuates from time to time that much, at any rate, and it will just kind of go in the general cost and when the cost gets high, somebody will put the price up and somebody else will follow; and when it goes down, somebody will cut and others will follow."

page 12 (Regular Conference); Chairman Williams: "There is another part of that same question, which I will try to answer myself, and perhaps Mr. Faker will want to join in. Why conceal the fact from the public that enrichment involves extra cost? I don't believe anybody has tried to conceal that fact. I have seen some advertising to the effect that "we have extra value at the same price; we are giving extra value at the same price." Mr. Faker, Vice Pres. of the Millers National Federation: "I think I agree with you thoroughly. Of course there are added costs, but the general emphasis is to get this new type of food to the people who need it most, and that is the people in the low income groups, and, naturally, the effort will be made to keep the cost down."

page 6 (Consumers Division); Dr. Mitchell, Nutrition Consultant to the Coordinator on Health Problems: "In some certain localities specially milled products have been made into breads that were selling at a tremendous premium and that question has come up recently, "Is this to sell at twice the price of ordinary bread?" and I have assured them that if there was any increase, it would be very, very slight, a matter of a cent, perhaps. But there is that fear that it is going to be sold at a high premium which, of course, would defeat its purpose for the low income group."

page 6 (Consumers Division); Mrs. Clara G. Snyder, Director of Foods and Nutrition of the Wheat Flour Institute: "I would like to ask an opinion of Mrs. Leavens. Mrs. Leavens, suppose we said we didn't know what the price of this bread would be, whether it would have to be advanced or not, but suppose the bread did have to cost the consumer a cent a loaf more. What effect do you think that might have on Mrs. Homemaker's interest in this bread? Mrs. Leavens: "I think it might reduce the consumption of bread. I don't know for a certainly, of course, but the effect of increasing the price of milk, for instance, has certainly had an effect. Even an increase of one cent a quart has reduced the consumption of milk. Whether the two can be compared, I cannot say."

CEREALS: Whole, Processed, Enriched

"ENRICHMENT", Defraying Cost of:

Bakers' Weekly, October 4, 1943, "Enriched Flour Cost Ceiling" (page 33):
As reported previously in our pages, the new and higher levels of enrichment for flour labeled "enriched" became effective on October 1st. The Office of Price Administration has taken cognizance, and has issued amendment 8 to MPR 296 which permits millers and blenders of enriched flour to charge an additional 7 cents per hundredweight over the present premium of 10 cents per hundred-weight over ceiling prices for the un-enriched flour. For the new and higher levels of enrichment, the total addition to the ceiling price after October 1st is therefore 17 cents per hundredweight or 34 cents per "barrel" of 200 lbs."

CEREALS: Whole, Processed, Enriched

BREAD, Effect of Leavening Agents on Nutrients of:

Sherman, H. C. and Pearson, Constance A., Modern Bread, The MacMillan Company, N. Y. C., 1942, (389.1 Sh5M), page 50: "According to a report in the Lancet for August 3, 1940, the joint committee of the Lister Institute and the Medical Research Council recommended: 2. That there be no treatment of flour with oxidizing agents or other foreign substance which may be suspected of injuring its nutritive value, 4. That the use of baking powders be discouraged because of the danger that they may increase the loss of thiamin in the baking process. Fincke and Little (1941) found that the heating necessary to cook wheat-germ muffins had in itself no measurable effect upon their thiamin content, but that this was diminished about 26 per cent when baking powder was used."

Nutrition Division of the Office of the Federal Coordinator of Health, Welfare, and Related Defense Activities, 20 Questions on Enriched Bread, 1941, (173.3 N54): "C. About Soda and Baking Powder? Use as usual but use soda sparingly as it tends to destroy vitamins."

Rose, Mary Swartz, The Foundations of Nutrition, The MacMillan Company, N. Y. C., 1938, page 270: Topic of discussion is Vitamin B (B_1)--- "Other losses in cooking which have not been mentioned above are losses due to dissolving in water which is thrown away and the addition of soda, which increases the rate at which the vitamin is destroyed."

Sherman, H. C., and Lanford, Caroline S., Essentials of Nutrition, MacMillan Company, N. Y. C., 1943, page 214: "In an investigation of wheat germ muffins, it was found that there was no cooking loss of measurable degree unless soda was used, but with the use of soda there was a loss of 26 per cent of the original amount of thiamin. (For the full account, see Fincke and Little (1941) in the list of Suggested Reading below, which list also gives references to other losses in cooking.)"

page 212: "Thiamin, like vitamin C, is (other conditions being equal) distinctly more stable in a moderately acid than in a correspondingly alkaline solution."

Williams, Robert R., and Tom D. Spies, Vitamin B_1 and Its Use in Medicine, MacMillan Co., N. Y. C., 1938, page 233: "In baking powder bread a substantial fraction of the thiamin was found to be destroyed. This can be corrected by rendering the dough acid."

Nutrition Reviews, The Nutrition Foundation, Inc., Chrysler Bldg., N. Y. C., Jan., 1943, 3, page 88: "Acidity favored retention of thiamin and alkalinity hastened destruction. Optimim retention of thiamin may be predicated if the pH does not become greater than 7.1 to 7.2 during the baking process."

[illegible]

CEREALS: Whole, Processed, Enriched

BREAD, Effect of Leavening Agents on Nutrients of:

Transcript of Discussion on "Enriched" Bread held by American Bakers and Millers in Chicago, Ill., March 5, 1941, page 9; Dr. Bailey: "Thiamin, for example, is sensitive to alkalis and is destroyed or inactivated in an alkaline medium. Therefore, it becomes increasingly important to control the level of acidity, relative acidity, or, as the chemist calls it, the pH, and it is deemed desirable to keep the pH in the range of what is sometimes referred to as absolute neutrality, or 7, or even slightly on the acid side of that level. Fortunately, in baking yeast-leavened bread, the dough and also the bread itself is commonly definitely on the acid side of neutrality."

The Journal of Nutrition, August 10, 1943, Vol. 26, No. 2, page 123, "Digestion of Whole Wheat and White Breads in the Human Stomach", by Rostorfer, Kochakian, and Murlin (Univ. of Rochester): "The peeled-wheat bread baked with high-vitamin yeast undergoes gastric proteolytic digestion 15% faster than when the bread is baked with ordinary baker's yeast; the free sugar formation under the amylolytic action of saliva is 11% faster."

CEREALS: Whole, Processed, Enriched

BREAD, Effect of Baking Heat on Nutrients of:

Wilder, Russell M., Chief, Civilian Food Requirements Branch, F.D.A., War Food Adm., Washington, D.C., July 21, 1943: "The nutrients added in enrichment, except in the case of thiamine, are stable and not lost in baking. The loss of thiamine in baking bread is of minor importance--about 15%. Similar loss of thiamine occurs in baking whole-wheat flour. The loss in baking soda biscuits and crackers or in making toast rarely exceeds 30%--the proportion of flour used for such products is relatively small."

Food and Nutrition Board, National Research Council, Washington, D.C., May 12, 1943, Tables of Vitamin Losses in Cooking Foods:"

	Thiamine,%loss	Riboflavin,%loss	Niacin,%loss
Bread	10-15	0	10
Grain Products	0-10	0	Negligible"

Sherman, H. C., and Pearson, Constance S., Modern Bread, MacMillan Co.,N.Y.C., 1942, (389.1 Sh5M), page 50: "Fincke and Little (1941) found that the heating necessary to cook wheat-germ muffins had in itself no measurable effect upon their thiamin content but that this was diminished about 26 percent when baking powder was used."

Sherman, H. C., and Lanford, Caroline S., Essentials of Nutrition, MacMillan Company, N.Y.C., 1943, page 213: "Baking losses as reported are now known to have been above the truth in some cases, because some of the methods used for determination of thiamin do not reveal the whole amount present in the baked product. In a special study made by the Food and Drug Administration and reported in the official hearings upon the proposed new standards for bread, the baking losses ranged from too little to measure, up to about 15 percent as a maximum, and averaged less than one tenth of the thiamin originally present in the dough from which the bread was made.

"In an investigation of wheat germ muffins, it was found that there was no cooking loss of measurable degree unless soda was used,." page 212: "Like other thermolabile substances thiamin is more stable to heating in a dry state than in solution.

Nutrition Reviews, The Nutr. Foundation, Inc., Chrysler Building, N.Y.C., Jan. 1943, 3, page 87: "Assays were conducted by Schultz and associates (Schultz, Atkin, and Frey, Cereal Chemistry 19, 532, 1942) on doughs and baked breads and the baking time varied by ten minute increments, from ten minutes (under-baked) to forty minutes (overbaked) in a rotary hearth oven at 410° F. Studies were made of the crust, the intermost crumb, and the intermediate crumb zone.

"Experimental breads consisted of enriched white bread containing added crystalline thiamine hydrochloride, enriched white bread containing "high vitamin B_1 yeast", and whole-wheat bread. All these were 1 pound loaves. Thiamine assays were conducted on doughs and finished baked breads.

"It was concluded that the stability of thiamine was not affected by its source. All sources of thiamine, during the normal bake, showed a loss of about 20 percent. Time of baking markedly influenced thiamine destruction. For example, the losses during baking for ten to forty minutes can be summarized as follows: White bread plus thiamine hydroxide, 3 to 33 percent; whole wheat bread, 2 to 33 percent, and white bread plus high vit.B_1 yeast, 6 to 32 percent. White

EFFECT, Effect of Baking Heat on Nutrients of:

Miller, Russell F., Chief, Division Food Requirements Branch, F.N.A., War Food Administration, Washington, D.C., July 21, 1944: "The nutrients added in enrichment, except in the case of thiamine, are stable and not lost in baking. The loss of thiamine in baking bread is of minor importance--about 15%. Similar loss of thiamine occurs in baking whole-wheat flour. The loss in baking soda biscuits and crackers or in making toast merely exceeds 50%--the proportion of flour used for such products is relatively small."

Food and Nutrition Board, National Research Council, Washington, D.C., May 10, 1944, Tables of Vitamin Losses in Cooking Foods:

	Thiamine, % loss	Riboflavin, % loss	Niacin, % loss
Bread	10-15	0	10
Grain Products	0-10	0	Negligible

Sherman, H. C., and Pearson, Constance S., Modern Bread, Macmillan Co., N.Y.C., 1942, (1943.1 Sh5M), page 50: "Kinsley and Little (1941) found that the baking necessary to cook wheat-germ muffins had in itself no measurable effect upon their thiamin content but that this was diminished about 20 percent when baking powder was used."

Sherman, W. C., and Lanford, Caroline S., Essentials of Nutrition, Macmillan Company, N.Y.C., 1943, page 213: "Baking losses as reported are not known to have been above the truth in some cases, because some of the methods used for determination of thiamin do not reveal the whole amount present in the baked product. In a special study made by the Food and Drug Administration and reported in the official hearings upon the proposed new standards for bread, the baking losses ranged from too little to measure, up to about 15 percent as a maximum and averaged less than one tenth of the thiamin originally present in the dough from which the bread was made.

"In an investigation of wheat germ muffins, it was found that there was no cooking loss of measurable degree unless soda was used." page 212: "Like other thermolabile substances thiamin is more stable to cooking in a dry state than in solution.

Nutrition Reviews, The Nutr. Foundation, Inc., Chrysler Building, N.Y.C., Jan. 1943, 3, page 87: "Assays were conducted by Sohnle and associates (Cereals, Milling, and Proc. Cereal Chemistry 19, 538, 1942) on doughs and baked breads and the baking time varied by ten minutes intervals, from ten minutes (under-baked) to forty minutes (overbaked) in a rotary hearth oven at 440° F. Studies were made of the crust, the interpenetral crust, and the interpenetrate crumb zone.

"Experimental breads consisted of enriched white bread containing added crystalline thiamine hydrochloride, enriched white bread containing "high vitamin B1 yeast", and whole-wheat bread. All these were 1 pound loaves. Thiamine assays were conducted on doughs and finished baked breads.

"It was concluded that the stability of thiamine was not affected by the source. All sources of thiamine, during the normal bake, showed a loss of about 20 percent. Time of baking markedly influences thiamine destruction. For example, the losses during baking for ten to forty minutes can be summarized as follows: White bread plus thiamine hydrochloride, 7 to 35 percent; whole wheat bread, 2 to 35 percent, and white bread plus high vit.B1 yeast, 6 to 32 percent. White

CEREALS: Whole, Processed, Enriched

BREAD, Effect of Baking Heat on Nutrients of: (continued)

bread made by commercial methods showed losses which varied from 21 to 26 percent, which is in close agreement with the losses in experimental breads baked for thirty minutes. As would be expected, the greatest losses occurred in the crust of all bread.

"In the study by Melnick and associates (Am. Baker, October (1941)) it was found that commercial nonenriched white bread contains on the average 0.35 mg. of thiamine per pound. . . . . "The average loss of thiamine in the tests conducted on a commercial scale was 16 percent."

"Destruction of thiamin varied from 15 to 30 percent. Thin crusty biscuits showed greater thiamine destruction than thick biscuits."

Nutrition Reviews, The Nutrition Foundation, Inc., Chrysler Building, N.Y.C., 1, 1942, page 3: "In view of the fact that niacin is the most stable vitamin known, the losses reported in cooking are surprisingly large. From one-third to one-half is lost in steaming, frying, or roasting and about 60 percent in baking. No explanation seems adequate to account for these large losses and they should be accepted with reservation until more data are available. If typical of cookery practice, losses of this magnitude will occasion great concern and a vast amount of recalculation of intake values."

Report of Food Research Laboratories, Inc., 114 E. 32 St., New York City, Aug. 12, 1941, page 1: "The greater destruction of thiamine in the crust was confirmed. The bottom crust of a hearth-baked bread showed more than twice the loss of thiamine as the top crust."

page 4: "Tests were conducted to determine the partition of thiamine between crust and crumb of the bread. For this purpose a hearth-baked "pumpernickel" bread was used, since it has a particularly heavy crust both on top and bottom. The thiamine loss in the top and bottom crust are based upon the thiamine lvalue of the crumb. The bottom crust contained 34% less thiamine, the top crust 13% less thiamine than the crumb after corrections had been made, so that the comparisons could be drawn with materials of the same moisture content."

page 3: "The final tests were conducted on basal and enriched breads baked under laboratory conditions under strict supervision with analyses conducted upon the enrichment ingredients. In these tests the thiamine loss varied from 6% to 26% with the average loss being 15%. This is in agreement with the average loss noted in tests conducted with the commercially baked loaves. The stability of the vitamin occurring naturally as phosphorylated thiamine (for the most part) in enriched yeast and as synthetic free thiamine in the tablet was found to be approximately the same when used to enrich these breads."

CEREALS: Whole, Processed, Enriched

BREAD, Effect of baking heat on vitamins of: (continued)

bread made by commercial methods showed losses which varied from 21 to 26 percent, which is in close agreement with the losses in experimental bread baked for thirty minutes. As would be expected, the greatest losses occurred in the crust of all bread.

"In the study by Pinkerton and associates (Am. Baker, October (1941)) it was found that commercial homogenized white bread contains on the average 0.15 mg. of thiamine per pound. . . . . "The average loss of thiamine in the tests conducted on a commercial scale was 16 percent."

"Destruction of thiamin varied from 15 to 30 percent. Thin crusty biscuits showed greater thiamine destruction than thick biscuits." Nutrition Review. The Nutrition Foundation, Inc., Chrysler Building, N.Y.C. 1, 1941, page 3. "In view of the fact that thiamin is the most stable vitamin known, the losses reported in cooking are surprisingly large. From one-third to one-half is lost in steaming, frying, or roasting and about 60 percent in baking. No explanation seems adequate to account for these large losses and they should be accepted with reservation until more data are available. If typical of cookery practice, losses of this magnitude will occasion great concern and a vast amount of reevaluation of intake values."

Report of Food Research Laboratories, Inc., 111 E. 22 St., New York City, Am 12, 1941, page 1. "The greater destruction of thiamine in the crust was confirmed. The bottom crust of a fourth-baked bread showed more than twice the loss of thiamine as the top crust."

Page 1: "Tests were conducted to determine the partition of thiamine between crust and crumb of the bread. For this purpose a hearth-baked "supremelet" bread was used, since it has a particular heavy crust both on top and bottom. The thiamine loss in the top and bottom crust are based upon the thiamine value of the crust. The bottom crust contained 34% less thiamine, the top crust 15% less thiamine than the crumb after corrections had been made, so that the comparisons could be drawn with materials of the same moisture content."

Page 2: "The final tests were conducted on bread and enriched bread baked under laboratory conditions under strict supervision with precautions exercised upon the ordinary ingredients. In these tests the thiamine loss varied from 6% to 26% with the average loss being 15%. This is in agreement with the average loss noted in tests conducted with the commercially baked loaves. The stability of the vitamin occurring naturally as phosphorylated thiamine (for the most part) in enriched yeast and as synthetic free thiamine in the tablet was found to be substantially the same when used in enriched bread."

CEREALS: Whole, Processed, Enriched

BREAD, Effect of Baking Heat on Nutrients of:

Report by the Food Research Laboratories, Inc., 114 E. 32 St., N.Y.C., 1941.
Table III:

"LABORATORY TESTS TO DETERMINE THIAMINE LOSS DURING BAKING

Air Dried Samples	Thiamine Content I. U. Per Lb.		Thiamine Destroyed by Baking, percent
Basal bread	113		26
Enriched bread	465	with yeast	13
Enriched bread	381		21
Enriched bread	423	" mg. tablet	9
Enriched bread	353		18
Whole Wheat bread	656		6 "

The Journal of Nutrition, June 10, 1943, "The Contribution of Non-Fat Solids to the Nutritive Value of Wheat Breads", by Mitchell, Hamilton, and Shields (Univ. of Ill.), page 601, "The baking of bread by a commercial method leads to inconsiderable destruction of thiamine in the dough and to inappreciable destruction of riboflavin."

CHAPTER: Whole, Unprocessed, Enriched

SECTION, Effect of Baking Meat on Nutrients etc:

Report by the Food Research Laboratories, Inc., 11E W. 32 St., N.Y.C., 1941, Table III.

"LABORATORY REPORT TO DETERMINE VITAMINS
IN 8 OF BAKING WARTIME
Air Dried Samples Thiamine Content Thiamine Destroyed by
I. U. per lb. Baking, percent

Wheat Germ	115		20
Enriched Bread	465	with yeast	15
Enriched Bread	371		21
Enriched Bread	427	" no. yeast	0
Enriched Bread	317		27
Whole Wheat Bread	254		6 "

The Journal of Nutrition, June 10, 1943, "The Nutritive Value of Non-Wheat Flours in the Nutritive Value of Wheat Breads", by Mitchell, Hamilton, and Wright (Univ. of Ill.), page 601, "The baking of bread by a commercial method leads to incorrectly reproduction of thiamin in the bread and to inappreciably decreased of riboflavin."

CEREALS: Whole, Processed, Enriched

BREAD, Effect of Toasting on Nutrients of:

Booher, Hartzler, Hewston, U.S.Dept. of Agr., Circular 638, May 1942, A Compilation of the Vitamin Values of Foods in Relation to Processing and Other Varients, (1 Ag84C), page 32: "

	Thiamin (vitamin B_1) micrograms per 100 grams of edible portion	
Wheat bread*, made with high-vitamin-B_1 yeast; New York; fermentation method:		
Before toasting	1,230	
Lightly toasted		1,080
Medium toasted		1,020
Heavily toasted		970
Before toasting	490	
Made into light toast		470
Medium toast		420
Heavily toasted		370
Before toasting	1,020	
Made into melba toast		750
Wheat bread, white, New York, fermentation method:		
Before toasting	100.5	
Crust of toasted slice		100
1/2 inch directly under crust of toasted slice		120
Center portion of toasted slice		120
Entire toasted slice		110
Before toasting	100	
Lightly toasted		100
Medium toasted		100
Heavily toasted		100
Before toasting	110	
Made into melba toast		100
Wheat bread, white, made with high-vitamin-B_1 yeast; New York; fermentation method:		
Crust of toasted slice		690
1/2 inch directly under crust of toasted slice		870
Center portion of toasted slice		1,080
Entire toasted slice		1,020 "

* This is probably white bread

CEREALS: Whole, Processed, Enriched

BREAD, Effect of Toasting on Nutrients of:

Booher, Bartelsy, Hewston, U.S.Dept. of Agr., Circular 636, May 1942.
A Compilation of the Vitamin Values of Foods in Relation to Processing and Other Variants, (I Agric), page 20:

	Thiamin (vitamin B_1) micrograms per 100 grams of edible portion
Wheat bread*, made with high-vitamin-B_1 yeast; New York: fermentation method:	
Before toasting	1,290
Lightly toasted	1,080
Medium toasted	1,020
Heavily toasted	970
Before toasting	490
Made into light toast	470
Medium toast	420
Heavily toasted	370
Before toasting	1,020
Made into melba toast	790
Wheat bread, white, New York, fermentation method:	
Before toasting	100.5
Crust of toasted slice	100
1/2 inch directly under crust of toasted slice	120
Center portion of toasted slice	120
Entire toasted slice	110
Before toasting	100
Lightly toasted	100
Medium toasted	100
Heavily toasted	100
Before toasting	110
Made into melba toast	100
Wheat bread, white, made with high-vitamin-B_1 yeast; New York: fermentation method:	
Crust of toasted slice	690
1/2 inch directly under crust of toasted slice	670
Center portion of toasted slice	1,080
Entire toasted slice	1,020 "

* This is probably white bread

CEREALS: Whole, Processed, Enriched

BREAD, Effect of Toasting on Nutrients of:

Booher, Hartzler, and Hewston, (continuation of page 1.)

	Thiamin (vitamin B_1) micrograms per 100 grams of edible portion	
"Wheat bread, whole, New York, fermentation method:		
Before toasting	670	
Lightly toasted		670
Medium toasted		650
Heavily toasted		590
Crust of toasted slice		530
1/2 inch directly under crust of toasted slice		670
Center portion of toasted slice		750
Entire toasted slice		680 "

Wilder, Russell M., Chief, Civilian Food Requirements Branch, F.D.A.,War Food Adm., Washington, D.C., July 21, 1943: Concerning the destruction of thiamin: "The loss in baking soda biscuits and crackers or in making toast rarely exceeds 30 percent."

How to Use Bread in Modern Baking, Zinsmaster Baking Company, 1942, (our files C-221), page 23: "Effect of Toasting Bread on Vitamin Content: It is recommended that bread be toasted lightly or not at all as thiamin is readily destroyed by dry heat. For variety's sake toast is used occasionally in menus. Thin toast loses more thiamin than thick toast. Melba toast loses most of all. This should be noted when including them in the dietary."

Nutrition Reviews, The Nutrition Foundations, Inc., Chrysler Bldg., N.Y.C., Jan 1943, 3, page 88: "(Melnick, Mabardie, Bernstein, and Oser, American Baker, Oct. 1941) Toasting of bread led to an additional loss of thiamine ranging from 11 to 25 percent depending upon the degree of toasting. Toast as usually prepared contained about 15 percent less thiamine than the original bread."

Report, Food Research Laboratories, Inc., 114 E. 32 St., N.Y.C., 1941, page1: "Toasting of bread results in an additional loss of thiamin of 11 to 25 percent, this extent of such loss ranging with the degree of toasting. Toast as usually prepared contains about 15% less thiamine than the original slice of bread."

page 4: "The best index of the degree of toasting in the determination of the total solids, since moisture is the primary bulk which is lost and the extent of such loss varies with the degree of toasting. When the thiamine content is calculated in terms of the same total solid content per slice, a direct proportion is found between the degree of toasting and thiamine destroyed. Light toast contains 11% less thiamine than the original bread, toast as usually prepared contained 15% less thiamine and fully 25% was lost in preparing heavy toast."

[illegible]: Whole, Processed, Enriched

[illegible], Effect of Toasting on Vitamin [illegible]:

[illegible], Thiamin, and Riboflavin, (continued from page 1.)

	Thiamin (vitamin B_1) micrograms per 100 grams of edible portion
"Wheat bread, whole, New York, Fermentation method:	
Before toasting	370
Lightly toasted	370
Medium toasted	370
Heavily toasted	370
Crust of toasted slice	370
1/2 inch directly under crust of toasted slice	370
Center portion of toasted slice	730
Entire toasted slice	[illegible]

Wilder, Russell M., Minot, William Todd Bartlemore and others, U.S.A., War Food Adm., Washington, D.C., July 21, 1943: Conserving the nutritive of thiamin: "The loss in baking was thought to be satisfactory or in making toast rarely exceeds 30 percent."

For the bread in Modern Baking, Interstate Baking Company, 1943, (our [illegible]), page 29: "Effect of Toasting Bread on Vitamin Content It is recommended that bread be toasted lightly or not at all as thiamin is readily destroyed by dry heat. For variety's sake toast is used occasionally in course. This toast loses more thiamin than white toast. Dark toast loses most of all. This should be noted when toasting bread in the oven."

Nutrition Services, The Nutrition Foundation, Inc., Chrysler Bldg., N.Y.C., Jan 1944, p. 3: "(Malnutrition, Dysentery, Beriberi, and Pellagra) Toasting of bread led to an additional loss of thiamin ranging from 11 to 29 percent depending upon the degree of toasting. Toast as usually prepared contained about 15 percent less thiamine than the original bread."

Report, from General Laboratories, Inc., 111 W. 39 St., N.Y.C., 1941, per "Toasting of bread results in an additional loss of thiamin of 11 to 29 percent, this amount of such loss ranging with the degree of toasting. Toast as usually prepared contains about 15% less thiamin than an original slice of bread."

Note: "The same order of the degree of toasting in the order [illegible] of the total folic, also volume in the primary bulk [illegible] the extent of such loss varies with the degree of toasting. When the folic content is calculated in terms of the [illegible] total solid content per gram, a direct proportion is found between the degree of toasting and folic destroyed. Light toast [illegible] 11% loss thiamine and 15% folic. Medium toast [illegible] 15% loss thiamine and 21% folic. Dark toast [illegible] 29% loss thiamine and 71% folic. Toast [illegible] 30% loss thiamine and 71% folic in [illegible] toast."

CEREALS: Whole, Processed, Enriched

BREAD, Effect of Toasting on Nutrients of:

Cereal Chemistry, May, 1943, Volume XX, No.3, Lancaster, Pa., page 352, "Thiamin Losses in Toasting Bread", by Downs and Meckel: "Surveys show that much bread is consumed as toast. In some areas this is said to exceed 35% of the total consumption."
. . . The following table was among reports read at the annual meeting of the American Institute of Baking, Chicago, Ill, May 1942:

Thiamin and Moisture in Bread and Toast
(All data converted to 38.0% moisture basis)

	Toasted (Seconds)	Moisture %	Moisture loss %	Thiamine microgr. per gm.	Thiamin loss %	Thiamin in 6 slices toast %
Unenriched	0	38.0	0.0	0.86	0.0	0.138
White Br.	30	32.7	14.0	0.78	9.2	0.126
	40	31.3	17.6	0.67	22.1	0.108
	50	29.2	23.1	0.69	19.7	0.110
	60	24.3	36.0	0.63	26.7	0.102
	70	23.0	39.5	0.59	31.4	0.096
Enriched	0	38.0	0.0	2.76	0.0	0.496
White	30	34.6	9.0	2.62	5.2	0.454
Bread	40	30.9	18.6	2.57	7.0	0.444
	50	29.9	21.4	2.40	13.0	0.414
	60	28.4	25.3	2.35	15.0	0.406
	70	26.2	31.0	2.29	17.0	0.396
100%	0	38.0	0.0	3.36	0.0	0.532
Whole	30	32.1	15.6	3.22	4.0	0.506
Wheat	40	30.0	21.0	3.08	8.2	0.486
	50	29.9	21.3	2.94	12.5	0.462
	60	25.6	32.6	2.85	15.3	0.450
	70	24.5	35.5	2.65	21.0	0.418

"Ten persons were asked to view the toast samples and express their preference as to degree of tasting. Eight preferred samples toasted 50 seconds; one preferred 40 seconds; and the tenth said he liked his toast between the 40 and the 50 second sample."

EFFECT. Effect of Toasting on Nutrients of:

Cereal Chemistry, Vol. XXV, No.3, Lancaster, Pa., page 252, "Thiamin Losses in Toasting Bread", by Town and Bechtel: "Surveys show that such bread is consumed as toast. In some areas this is said to exceed 35% of the total consumption."
. . . The following table was among results read at the annual meeting of the American Institute of Baking, Chicago, Ill., May 1942:

Thiamin and Moisture in Bread and Toast
(All data converted to 36.0% moisture basis)

Toasted (Browned) %	Moisture Loss %	Thiamine Loss %	Thiamine mg. per gm.	Thiamin in % slice toast %
Uncontrolled 0	36.0	0.0	0.86	0.120
White Lev. 30	32.7	14.0	0.78	0.126
40	31.3	17.6	0.67	0.108
50	30.2	23.1	0.60	0.110
60	34.3	36.0	0.63	0.102
70	23.0	39.5	0.39	0.066
Enriched 0	38.0	0.0	2.76	0.465
White 30	34.4	9.8	2.62	0.444
Bread 40	30.4	18.6	2.37	0.414
50	29.0	21.4	2.40	0.413
60	26.4	24.3	2.36	0.406
70	24.2	31.0	2.09	0.396
Rye 0	36.0	0.0	3.36	0.572
Whole 30	32.1	15.6	3.22	0.506
Meal 40	30.0	21.0	3.08	0.486
50	29.0	21.3	2.64	0.462
60	25.6	32.6	2.35	0.450
70	24.3	35.5	2.65	0.418

"Ten persons were asked to view the toast samples and express their preference as to degree of browning. Eight preferred samples toasted 40 seconds; one preferred 40 seconds, and the tenth said he liked his toast between the 40 and the 50 second samples."

CEREALS: Whole, Processed, Enriched

BREAD, Use of Milk in:

Nutrition Reviews, Nutrition Foundation, Inc., Chrysler Gldg., N.Y.C., Jan. 1943, 3 page 88: "Biscuits made with milk seemed to show somewhat greater thiamine retention than water biscuits." (Cereal Chem., 19, 121 (1942)).

Sherman, H. C., and Constance S. Pearson, Modern Bread, MacMillan Co., 1942 page 27: "Thus the proteins of white flour arelatively poor in lysine and tryptophane, while the proteins of milk, eggs, and meat are relatively rich in both these amino acids.

"In an extended series of researches by Osborne and Mendel (1919), it was found that, while the proteins of white flour - even when fed at liberal percentages of the food mixture - supported little if any growth, good growth was obtained when either milk, eggs, or meat protein constituted one-third, and white-flour protein two-thirds, of the total food protein.

"Our own exploratory research experiments tend to indicate also that, when dried skim milk is used in breadmaking in the proportion of six pounds to each hundred pounds of white flour, the proteins of the latter are so supplemented that the resulting white bread is adequate in meeting the protein requirement of growth. Such bread, however, is not equally adequate as a source of some of the mineral elements and vitamins."

page 37: "On the other hand, the addition of milk (chiefly as skim milk solids) in breadmaking, which significantly enriches the bread in calcium as well as in protein, riboflavin, and some other nutritional factors, has increased markedly in the United States during the past ten or twelve years. It is now reported that most of the baker's bread made in this country, other than that of the so-called French and Italian types, contains skim-milk powder to the extent of about six pounds for each one hundred pounds of flour used. Such an addition of milk solids would rather more than double the calcium content which ordinary white bread would otherwise have."

page 79: "This exploratory research, considered in comparison with earlier experiments in this laboratory in whichwater bread was used, may be taken to indicate an objectively demonstrable nutritional superiority in the bread made with 6 percent as much skim-milk powder as white flour, but may not be takenradically to change the position of bread as a food."

Nutrition Reviews, Nutrition Foundation, Inc., Chrysler Building, N.Y.C., August 1943, page 297: "Not all the flour in the American diet is consumed in the form of bread and not all bread is made with 6 per cent dried skim milk. Indeed, the amount of dried skim milk available is insufficient at the present moment to permit the enrichment of all white pan bakers' bread to this extent. The first order of the Food Administrator required that all white bakers' bread, beginning Jan. 1943, should be enriched with . . . . . ., and not less than 3 percent nor more than 4 percent (based on the weight of the flour as 100 percent) of dried skim milk. It has been recommended by the Food and Nutrition Board that when supplies become available, the amount of dried skim milk in white pan bread be increased to the 6 percent level."

CEREALS: Whole, Processed, Enriched

BREAD, Use of Milk in:

Nutrition Reviews, Nutrition Foundation, Inc., Chrysler Bldg., N.Y.C., Jan. 1943, 3 page 10: "Dialysis made with milk seemed to show somewhat greater thiamine retention than water dialysis." (General Conv., 29, 102 (1942)).

Sherman, H. C., and Gomathanayagam S. Harrison, Modern Bread, MacMillan Co., 1942 page 27: "Due the proteins of white flour relatively poor in lysine and tryptophane, while the proteins of milk, eggs, and meat are relatively rich in both these amino acids.

"In an extended series of researches by Sherman and Bondel (1918) it was found that, while the proteins of white flour - even when fo at liberal percentages of the food mixture - supported little if any growth, good growth was obtained when either milk, eggs, or meat protein constituted one-third, and white-flour protein two-thirds, the total food protein.

"Our own exploratory research experiments tend to indicate also that, when dried skim milk is used in freshening in the proportion of six pounds to each hundred pounds of white flour, the proteins of the latter are so supplemented that the resulting white bread is adequate in meeting the protein requirement of growth. Such bread, however, is not equally adequate as a source of some of the mineral elements and vitamins."

page 37: "On the other hand, the addition of milk (chiefly as skim milk solids) in breadmaking, which significantly enriches the bread in calcium as well as in protein, riboflavin, and some other nutritional factors, has increased markedly in the United States during the past ten or twelve years. It is now reported that most of the baker's bread made in this country, other than that of the so-called French and Italian types, contains skim-milk powder to the extent of about six pounds for each one hundred pounds of flour used. Such an addition of milk solids would rather more than double the calcium content which ordinary white bread would otherwise have."

page 78: "This exploratory research, considered in comparison with earlier experiments in this laboratory in which water bread was used, may be taken to indicate an objectively demonstrable nutritional superiority in the bread made with 6 percent skim-milk powder, as white flour, but may not be taken indicative to change the position of bread as a food."

Nutrition Reviews, Nutrition Foundation, Inc., Chrysler Building, N.Y.C., August 1943, page 127: "For all the flour in the American diet is converted in the form of bread and not all bread is made with 6 percent dried skim milk. Indeed, the amount of dried skim milk available is insufficient at the present moment to permit the enrichment of all white commercial bread to this extent. The first order of the Food Administrator required that all white bakers' bread, beginning June, 1943, should be enriched with . . . . . , and not less than 3 percent nor more than 6 percent (based on the weight of the flour as 100 percent) of dried skim milk. It has been recommended by the Food and Nutrition Board that when supplies become available the amount of dried skim milk in white bread be increased to the 6 percent level."

CEREALS: Whole, Processed, Enriched

BREAD, Use of Milk in:

The Journal of Nutrition, June 10, 1943, "The Contribution of Non-Fat-Milk Solids to the Nutritive Value of Wheat Breads", by Mitchell, Hamilton, and Shields (Univ. of Ill.), page 601: "Enriched white bread containing 6% of dried skim milk is definitely superior in growth-promoting value and in hemoglobin production to enriched white bread supplemented to an equivalent extent with dicalcium phosphate and riboflavin; however, the former is definitely, if only slightly, inferior to the latter in bone calcifying value."

CEREALS: Whole, Processed, Enriched

BREAD, Shortening In:

Nutritition Reviews, the Nutrition Foundation Inc., Chrysler Bldg., N.Y.C., August, 1943 , page 207: "The first order of the Food Administration required that all white bakers' bread, beginning January 1943, should be enriched with thiamine, niacin, and iron, and also that it contain not more than 2 percent of shortening, and not less than 3 percent nor more than 4 percent of dried skim milk."

CEREALS: Whole, Processed, Enriched

BREAD, GOVERNMENT REGULATION OF:

Federal Register, Aug. 3, 1943; page 10786

Food and Drug Adm., Farm Security Agency: Various Kinds of Breads, definition and standards of identity. Regulations:

Sect. 17.5: Bread and rolls or buns; identity; label statement of optional ingredients. (a) Should be made of flour, liquid, salt, and it may contain one or more of the twelve following ingredients: shortening; milk; buttermilk; eggs; sugar; malt; vegetable flour; ground soybeans; calcium or ammonium phosphates or sulphates; bromates, iodates, or peroxides; monocalcium phosphate, vinegar, and and calcium or sodium propionate (if either the former of the latter is used the label must read -- "added to retard spoilage"); and spice (in this case the label must read "spiced" or "spice added" etc.)

(b) Loaves must weigh one-half pound or more after baking, and rolls and buns are made into units each of which weighs less than one-half pound after baking.

Sect. 17.6: Enriched bread and enriched rolls or enriched buns; identity; label statement of optional ingredients. It shall conform to definition and standard of identity and be subject to label statement for optional ingredients of bread in section 17.5, except that it contain in each pound not more nor less than the prescribed amounts of the following ingredients; thiamin, riboflavin, niacin, iron. It may also contain Vitamin D, calcium, and wheat germ. Enriched flour may be used in whole or in part instead of flour The prescribed amounts of required or optional ingredients may be added by means of enriched flour, or through direct addition of such substances, or through the use of any ingredient containing such substance (high vitamin B yeast).

Sect. 17.7: Milk Bread and milk rolls or buns--bread made as prescribed in Sect. 17.5 except that milk is added.

Sect. 17.8: Raisin Bread and raisin rolls or raisin buns - bread made as prescribed in Sect. 17.5 except that raisins are added.

Sect. 17.9: Whole wheat bread, graham bread, entire wheat bread, and whole wheat rolls, graham rolls, entire wheat rolls, or whole wheat buns, graham buns, entire wheat buns - made as prescribed in Sect. 17.5 except that the dough is made with whole wheat flour and no flour is used therein.

Sect. 17.10: Breads and rolls or buns made with mixtures of flour, whole wheat flour, cracked wheat, crushed wheat - made as prescribed in Sect. 17.5 except that the dough is made of a mixture of two or more of the following wheat ingredients: flour, whole wheat flour, cracked wheat and crushed wheat. The bread, rolls or buns made from such mixtures is named according to the ingredient in predominance. Graham, whole wheat, and entire wheat are names of synonymous usage.

[illegible]: Whole, Processed, Enriched

[illegible], [illegible] REGULATION OF:

Federal Register, Aug. 3, 1943; page 10726

Food and Drug Adm., Food Security Agency: Various kinds of Breads, definition and standards of identity. Regulations:

Part. 17.1: Bread and rolls or buns; identity; label statement of optional ingredients. (a) Should be made of flour, liquid, salt, and in any combination one or more of the twelve following ingredients: milk; buttermilk; cream; sugar; malt; vegetable flour; gluten; soybeans; calcium or ammonium phosphates or sulphates; ammonium, sulfates, or phosphates; monocalcium phosphate, vinegar, or solution or sodium propionate (if either the former of the latter is used the label must read - "added to retard mold"); and eggs (in this case the label must read "eggs added" or "eggs added").

(b) Loaves must weigh one-half pound or more after baking, and rolls and buns are made into units each of which weighs less than one-half pound after baking.

Part. 17.2: Enriched bread and enriched rolls or enriched buns; identity; label statement of optional ingredients. It shall conform to definition and standard of identity and be subject to label statement for optional ingredients of bread in section 17.5, except that it contains in each pound and more not less than the prescribed amounts of the following ingredients: thiamin, riboflavin, niacin, iron. It may also contain Vitamin D, calcium, and wheat germ. Enriched flour may be used in whole or in part instead of flour in the prescribed amounts of required or optional ingredients may be added by means of enriched flour, or through direct addition of such substances, or through the use of any ingredient containing such substance (high vitamin B yeast).

Part. 17.3: Milk bread and milk rolls or buns--bread made as prescribed in part. 17.5 except that milk is added.

Part. 17.4: Raisin bread and raisin rolls or raisin buns - bread as prescribed in part. 17.5 except that raisins are added.

Part. 17.5: Whole wheat bread, graham bread, entire wheat bread, and whole wheat rolls, graham rolls, entire wheat rolls, or whole wheat buns, graham buns, entire wheat buns - made as prescribed in part. 17.5 except that the dough is made with whole wheat flour or graham flour or wheat flour.

Part. 17.6: Breads and rolls or buns made with mixtures of flour, whole wheat flour, graham flour, enriched wheat, enriched wheat - made as prescribed in part. 17.5 except that the dough is made of a mixture of two or more of the following wheat ingredients: flour, whole wheat flour, graham wheat and enriched wheat. The bread, rolls or buns made from such mixtures is named according to the ingredient in greater proportion. Graham, whole wheat, and entire wheat are names of synonymous usage.

CEREALS: Whole, Processed, Enriched

EFFECT OF DRYING ON NUTRIENTS OF FLOUR AND BREAD:

Rose, Mary Swartz, The Foundations of Nutrition, MacMillan Co., 1938, page 272: Discussion of vitamin B_1: "Drying does not seem to affect this vitamin unfavorably."

Booher, Hartzler, and Hewston, U.S. Dept. of Agr., Circular 638, May 1942, A Compilation of the Vitamin Values of Foods in Relation to Processing and Other Varients, (1 Ag84C), page 32: "

Bread, wheat, made with commercially enriched flour, bakery sample, 1/2 inch thick, and slices removed; Washington, D.C.; rat growth method:	Thiamin Vitamin B_1 Micrograms Per 100 gms of Edible Portion	
Fresh whole slices, average for six loaves.	240	
Dried whole slices, average for six loaves, 33.6 percent moisture .		370
Fresh crust, 1/4 inch thick, composited from 14 loaves, 23.6% moisture.	220	
Dried crust, 1/4-inch thick, composited from 14 loaves.		290
Fresh, inner portion of slices, 1/4-inch crust removed, 39.4% moisture	240	
Dried, inner portion of slices, 1/4-inch crust removed. "		400

Sherman, H. C., and Caroline S. Lanford, Essentials of Nutrition, MacMillan Company, New York, 1943, page 212: "Nature dry, unbroken seeds seem to contain their thiamin in a relatively stable form and favorable environment. In one published report, the evidence of local records was accepted as showing that wheat taken from the bottom of a certain tight dry granary compartment was a century old. On feeding to experimentals animals it was found to be a potent source of thiamin."

Williams, Ribert R., and Tom D. Spies, Vitamin B_1 and its Use in Medicine, MacMillan Company, N.Y.C., 1938, (448 W672), page 232: "In yeast breads there appears to be fairly general agreement that the thiamin content on an air-dry basis corresponds very closely to that of the flours used. The yeast which is used in proportions of 1 part to 100 of flour or less does not add significantly to the thiamin content. Copping and Roscoe's results by the rat growth method are typical:

	Air Dried	Fresh	
White, sponge	1.0	0.68 (	
White, short dough	1.48	1.0 (	
White, long dough	1.48	1.0 (	from 72% flours. "
Whole meal	4.72	3.0 (	

[illegible] on potency of [illegible] and [illegible]:

[illegible], [illegible] Burtz, The Foundations of Nutrition, [illegible] Co., 1932, [illegible]: "Disease of vitamin B_1: 'Drying does not seem to affect this vitamin unfavorably.'"

[illegible], [illegible], and Hewston, U.S. Dept. of Agr., Circular 639, May 1942, A Compilation of the Vitamin Values of Foods in Relation to Nutrition and Other Sciences, [illegible], page 32:

	Vitamin B_1	Micrograms per 100 gms of Edible Portion
[illegible] wheat, made with commercially enriched flour, [illegible] baking sample, 1/2 inch thick, and crust removed; [illegible]		320
[illegible] wheat, yeast growth method:		
[illegible] whole wheat slices, average for six loaves,		240
[illegible] whole wheat slices, average for six loaves, 32.6% moisture content.		370
[illegible] wheat bread, 1/4 inch thick, composited from 14 loaves, 22.6% moisture.		320
[illegible] wheat crust, 1/4-inch thick, composited from 14 loaves.		290
[illegible] wheat, inner portion of slices, 1/4-inch crust removed, 32.4% moisture		240
[illegible] wheat, inner portion of slices, 1/4-inch crust removed.		320

Sherman, [illegible] and Geroline S. Lanford, Essentials of Nutrition, Macmillan Company, New York, 1942, page 242: "Every dry, well-ripened seed contains enough thiamin to a relatively stable form and functions in a dormant. In one published report, the evidence of [illegible] was recorded as showing that wheat taken from the [illegible] of a certain tight dry granary compartment was a century old. On feeding to experimentally animals it was found to be a potent source of thiamin."

Williams, Robert R., and Tom D. Spies, Vitamin B_1 and its Use in Medicine, The Macmillan Company, N.Y., 1938, (USE [illegible]), page 234: "Improved methods have appeared to justify general agreement that the thiamin content of an air-dry basis corresponds very closely to that in the fresh state. No yeast which is used in proportions of 1 part in 100 of flour or less does not add significantly to the thiamin content. Cowgill and Toscani's results by the new method are tabulated:

	Air Dried	Fresh	
[illegible], orange	1.0	0.62	(
[illegible], short grain	1.0	1.0	(
[illegible], long grain	1.08	1.0	(from 72% flour
[illegible] meal	1.72	1.0	(

CEREALS: Whole, Processed, Enriched

EFFECT OF DRYING ON NUTRIENTS OF FLOUR AND BREAD

Nutrition Reviews, the Nutrition Foundation, Inc., Chrysler Bldg., N.Y.C., Vol. 1, No. 9, July, 1943, page 288: "Thiamin Stability in Wheat Germ": "Students of nutrition will be interested in his observation that the thiamin content, as determined by the thiochrome method, did not vary even though the wheat germ might become rancid. Thus in one series of experiments, the thiamine content was initially 14.2 micograms to the gram, and after two weeks 15.5 micograms to the grams, where the value remained constant for 36 weeks."

Science, The Science Press, Lancaster, Pa., July 3, 1942, page 22, "Destruction of Riboflavin by Light.": "It seemed noteworthy that large losses, up to 48 percent, occurred in instances in which cooking was done in open vessels so that the food was exposed to light during cooking.

Light Destruction of Riboflavin in Solution

Time of exposure, minutes (Temperature--100°C.)	Percent destruction pH 3	pH 4.5	pH 6.5
5	16	28	42
15	42	62	72
30	60	84	91
45		90	99
60	95	97	99

Time of exposure, 1 hr.	Percent destruction Temperature 32°	75°	100°
pH 3			95
pH 4.5	16	66	97
pH 6.5	51	99	99

Dark, 100° for 1 hour	Percent destruction
pH 4.5	1
pH 6.5	0

It is apparent from Table 1 that increases wither in alkalinity or temperature accelerate the destruction of riboflavin, at quite a rapid rate. Temperature and pH affect the light reaction rather than other chemical destruction, for when riboflavin solutions are heated in the dark no destruction occurs.

CONCLUSIONS: Whole, Processed, Grinded

Effect of Light on Nutrition of Plant and Animal

Nutrition Reviews, the Nutrition Foundation, Inc., Chemical Abs., v.40, Vol. 5, No. 6, July, 1953, page 2[illegible]: "Thiamin Stability in Meat Meal", "Stability of nutrition will be increased in his observation that the thiamin content, as determined by the thiochrome method, did not vary even though the meat meal might become rancid. Thus in one series of experiments, the thiamine content was initially 11.2 micrograms in the meat, and after two weeks 11.5 micrograms to the gram, where the value remained constant for 52 weeks."

Science, The Science News, Lancaster, Pa., July 5, 1952, page 2[illegible], "Destruction of Vitaflavin by Light." "It seemed noteworthy that here Lowe, up to 4[illegible] percent, occurred in instances in which cooking was done in open vessels so that the food was exposed to light during cooking.

Light Destruction of Vitaflavin in Solution

Time of exposure, minutes (temperature--100°C.)	Percent destruction 25°C	75°C	100°C
5	14	23	40
15	16	37	72
30	40	63	81
45		70	89
60	18	77	90

Time of exposure, 1 hr.	Percent destruction Temperature 25°	75°	100°
90 %			95
80 %	10	60	97
60 %	21	90	99

Curve 100° for 1 hour	Percent destruction
60 %	1
50 %	0

It is apparent from Table 1 that increases within 1½ minutes in temperature causes the destruction of vitaflavin, at quite a rapid rate. Considered and if effect the light machine rather than other chemical destruction, the other allotropic methods are tested in the fact in nutritional source.

CEREALS: Whole, Processed, Enriched

MOISTURE CONTENT OF FLOUR AND BREAD:

Report, Food Research Laboratories, 114 East Thirty-Second St., N.Y.C., 1941, page 1, second part: from table concerning the analyses of commercial breads-- "The basic assumption in these tests is that 150 pounds of bread (35% moisture content) are derived from 100 pounds of flour."

page 4: "The best index of degree of toasting is the determination of the total solids, since moisture is the primary bulk which is lost and the extent of such loss varies with the degree of toasting."

Federal Register, Washington, D. C., May 27, 1941, page 2578, (Enactment by the Food Food and Drug Administration): "The flour is freed from bran coat, or bran coat and germ, to such extent that the percent of ash therein, calculated to a moisture-free basis is not more than the sum of one-twentieth of the percent of protein therein, calculated to a moisture-free basis, and 0.35. Its moisture content is not more than 15 percent."

CEREALS: Whole, Processed, Enriched

MOISTURE CONTENT OF FLOUR AND BREAD:

Powers, and Reserve Laboratories, 1.11 East Thirty-Second St., N.Y.C., 1941, page 1, second part: From table concerning the analyses of commercial breads-- "The basis assumption in these tests is that 150 pounds of bread (35% moisture content) are derived from 100 pounds of flour."

Page 4: "The best index of degree of toasting is the determination of the total solids, since moisture is the primary bulk which is lost and the extent of such loss varies with the degree of toasting."

Federal Register, Washington, D. C., May 27, 1941, page 2578, (Amendment to the Food Food and Drug Administration): "The flour is freed from bran coat, or bran coat and germ, to such extent that the percentage of ash therein, calculated to a moisture-free basis is not more than the sum of one-twenty-fifth of the percent of protein therein, calculated to a moisture-free basis, and 0.55. Its moisture content is not more than 15 percent."

CEREALS: Whole, Processed, Enriched

*RYE Bread and Flour:

Transcript of Discussion on "Enriched" Bread and Flour held at the National Conference of American Bakers and Millers in Chicago, Ill., March 5, 1941; page 3 of Regular Conference Report; Dr. Bailey: "Well, we'll talk about the rye grain, I guess. There are no great number of data available to me at the moment respecting the actual vitamin content of rye. Such as have been published indicate that insofar as the thiamine or B_1 is concerned, the level in whole rye is approximately that of wheat. However, in the instance of rye flour, I can only conjure at the moment, not having with me any precise date representing the vitamin content of the flour itself, but I fell that it is a reasonable assumption that the thiamine content, at least, of rye flour will be in the same general range as that of wheat flour of the same ash or mineral content. That is an assumption and further work will need to be done before we will know as much as we need to know about the levels in the rye flour itself."

page 10; Dr. William A. Quilan, General Counsel of the American Bakers Association: "However, I see no reason why the nutritionists, within their discretion, might not recommend that there be such a product as enriched rye bread. I believe there was some concern on that this afternoon and I attempted to get hold of Dr. Wilder or any of the other representatives of the National Research Council, but in that respect, as to the possibility of enlarging the recommendations to include such a product as rye bread, I think we might well hold that open for the time being, Mr. Chairman, and attempt to get some further information that might serve as a guide."

page 2; Dr. W. H. Sebrell, U.S. Public Health Official: "It is my personal opinion that an enriched rye bread should not be made and sold under the present conditions."

*Although rye may be mentioned elsewhere, the major part of the compilation on Cereals concerns wheat.

[illegible], Bran, Enriched, Enriched

Rye Grain and Flour:

There risk of interpreting an "enriched" grain and flour bill as the [illegible] National Conference of American Bakers and Millers in Chicago, [illegible], April 1, 1943, page 2 of Regular Conference Report [illegible] believe: "Still, we'll talk about the rye grain, I guess. There [illegible] any no great amount of data available to us at the moment regarding the actual vitamin content of rye. Such as there been published indicate that insofar as the thiamine or B1 is concerned, the [illegible] whole rye is approximately that of wheat. However, in the [illegible] of rye flour, I can only conjure at the moment, but have [illegible] with no any specific data representing the vitamin content of the flour itself. But I feel that it is a reasonable assumption that the thiamine content, at least, of rye flour will be in the same general range as that of wheat flour of the same ash or mineral content. That is an assumption and further work will need to be done before we will know as much as we need to know about the [illegible] in the rye flour itself."

Page 10, Dr. William A. Quilan, General Counsel of the American Bakers Association: "However, I see no reason why the nutritionists, within their discretion, might not recommend that there be such a product as enriched rye bread. I believe there was some concern on that this afternoon and I attempted to get hold of Dr. Miller or any of the other representatives of the National Research Council, but in that respect, as to the possibility of enriching the recommendations to include such a product as rye bread, I think we might hold that open for the time being. Dr. Stairwee, I attempt to get some further information that might serve as a guide."

Page 8, Dr. T. A. Harrell, Vice, White Health Official: "It is my personal opinion that an enriched rye bread should not be made and sold under the present conditions."

Although rye may be mentioned elsewhere, the major part of the consideration is towards wheat.

CEREALS: Whole, Processed, Enriched

CORNMEAL AND CORNBREAD:

Transcript of Discussion of "Enriched" Bread and Flour, held by the American Bakers and Millers at their National Conference in Chicago, Ill, March 5, 1941; Consumers Division, page 6; Miss Gladys E. Hall, Educational Director of the American Dietetic Association: "Another question might be grought up here, although perhaps it isn't the first concern of this group, and that is whether or not cornmeal would be a products that should be or might permissibly be enriched. Perhaps it comes in the class of soya been flour, which was brought up this afternoon. I don't know the answer to that but I am wondering." Dr. Helen Mitchell, Nutr. Consultant to the Coordinator on Health Problems: "The question has been brought to me several times as to whether cereals of various types, including cornmeal or wheat cereals, were going to be enriched and whether standards will be set up for them, and I have answered that as yet no such idea is in mind and no standards have been set; that whole grain breakfast cereals are still just as good as they always have been and that there is no reason to set up any special standards. But the cornmeal that is on the market, as I understand it, does not contain the germ and bran, except that cornmeal which is ground in the small local mills in the South.

"The nicotinic acid question in the South, of course, is one which has been brought up in the previous round table and corn, even when whole, as I understand it, does not contain as much as wheat. Therefore, the deficiency of nicotinic acid is accentuated in that part of the country where corn is consumed in larger quantities than is wheat."

*Although cornmeal and cornbread may be mentioned elsewhere, the major part of this compilation on Cereals concerns wheat.

CEREAL AND CONSUMERS:

Transcript of discussion of "Enriched" Bread and Flour, held by the American Bakers and Millers at their National Conference in Chicago, Ill., March 5, 1941; Consumers Division, page 6; Miss Clarke H. Hall, Educational Director of the American Dietetic Association: "Another question might be brought up here, although perhaps it isn't the first concern of this group, and that is whether or not commerce would be a produce that should be or might per haeibly be enriched. Perhaps it comes in the class of soya bean flour, which was brought up this afternoon. I don't know the answer to that but I am wondering." Dr. Helen Mitchell Ruhr, Consultant to the Coordinator on Health Problems: "The question has been brought to me several times as to whether cereals of various types, including commerce or wheat cereals, were going to be enriched and whether standards will be set up for them, and I have answered that as yet no such idea is in mind and no standards have been set; that whole grain breakfast cereals are still just as good as they always have been and that there is no reason to set up any special standards. But the commerce that is on the market, as I understand it, does not contain the germ and bran, except that commerce which is ground in the small local mills in the South.

"The nicotinic acid question in the South, of course, is one which has been brought up in the previous round table and even, even when whole, as I understand it, does not contain as much as wheat. Therefore, the deficiency of nicotinic acid is accentuated in that part of the country where corn is consumed in larger quantities than is wheat."

*Although commerce and cornbread may be mentioned elsewhere, the major part of this consultation on Cereals concerns wheat.

CEREALS: Whole, Processed, Enriched

CORNMEAL AND CORNBREAD:

The Enrichment of Cornmeal and Grits, E. J. Lease, South Carolina Agricultural Experiment Station, Clemson, South Carolina, May 1943, Circular 64: "Summary 1. Grits and degerminated corn meal are like white and patent flour in that they have undergone a refining process whereby most of the vitamins and minerals have been milled away. 2. Much emphasis has been placed upon the enrichment of white flour but until recently very little attention has been given to the enrichment of corn meal and grits. 3. At the request of the State Nutrition Committee and several other organizations the South Carolina General Assembly enacted a law which required the enrichment of grits and degerminated corn meal sold in South Carolina. 4. The enrichment of corn meal of all types is usually accomplished by the same mixing process as is used in enriching white flour. 5. Since grits are washed before cooking, it is necessary to use a special granular premix to enrich them. The enriching ingredients are not lost from this premix in washing because they are enveloped in gelatinized starchy particles. 6. The enrichment of corn meal and grits does not change their appearance, cooking properties, or taste, but does add materially to their nutritional value. 7. The total cost of enrichment is about 15 cents per 100 pounds of grits, about 10 cents per 100 pounds of degerminated corn meal, and 5 cents or less per 100 pounds of whole-corn meal.

SPECIALTY: Mills, Processes, Equipment

REFERENCES AND DESCRIPTIONS:

The Institute of Textile and Grain, E. C. Lane, South Carolina Agricultural Experiment Station, Clemson, South Carolina, January 1947, Bulletin 6: Summary 1. Grits and lemmahated corn meal are like white and yellow flour in that they have undergone a refining process whereby most of the vitamins and minerals have been milled away. 2. Much of the germ has been removed from the enrichment of white flour but until recently very little attention has been given to the enrichment of corn meal and grits. 3. At the request of the Nutrition Committee and several other organizations the South Carolina Textile Assembly made a law which required the enrichment of grits and degerminated corn meal sold in South Carolina. 4. The enrichment of corn meal of all types is usually accomplished by the same mixing process as is used in enriching white flour. 5. Since grits are washed before cooking, it is necessary to use a special vacuum mixer to mix them. The enrichmen ingredients are not lost from grits in washing because they are enveloped in relatively strongly particles. 6. The enrichment of corn meal and grits does not change their appearance, cooking properties, or taste, but does add materials to their nutritional value. 7. The total cost of enrichment is about 12 cents per 100 pounds of grits, about 10 cents per 100 pounds of degerminated corn meal, and 5 cents or less per 100 pounds of whole-corn meal.

CEREALS, Whole, Processed, Enriched

BUCKWHEAT:

War Emergency Bulletin, Cornell Bulletin for Homemakers, March 1943, Bulletin 576, "Bread and Whole-Grain Cereals", page 2: "Cornmeal, rye and buckwheat are classed also as whole-grain products. Although they are not so nutritious as are soybeans, whole wheat, or oats, they contain more food value than do more refined products, and their occasional use adds variety to the menu.

CEREALS: Whole, Processed, Enriched

REFERENCES:

For Emergency Bulletin, Cereal Bulletin for Housewives, Brown Bag, Bulletin 376, "Bread and Whole-Grain Cereals", page 2: "Cornmeal, rye and buckwheat are classed also as whole-grain products. Although they are not in multitudes as are soybeans, whole wheat, or oats, they contain more food value than do more refined products, and their occasional use adds variety to the menu.

A P P E N D I C E S

APPENDICES

CEREALS: Whole, Processed, Enriched

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Report of Food Research Labs., Inc., 114 East 32 St., New York, 1941
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Zionmaster Baking Company, "How to Use Bread in Modern Meals", 1942

COMPARISON OF NUTRIENTS IN ENRICHED FLOUR AND BREAD SPECIFIED BY LEGISLATION OF 1941 WITH NUTRIENTS SPECIFIED BY AMENDMENTS OF 1943

	THIAMIN			
	1941		1943	
Amount in 1 lb. flour (a)	1.66 mg -	2.5 mg	2. mg -	2.5 mg
Amount in 1 lb. bread (b)	1. mg -	4. mg	1.1 mg -	1.8 mg
Amount in 1 slice (1 oz.) bread	0.06 mg -	0.25 mg	0.07 mg -	0.11 mg
Amount in 6 slices (6 ozs.) bread	0.38 mg -	1.5 mg	0.41 mg -	0.67 mg
N.R.C., Recommended Daily Allowances, Man (70 Kg.) Mod. Active--3000 cal. (d)	----- 1.8 mg -------			
Percent Recommended Daily Allowance contributed by 1 lb. flour	92% -	139% -	111% -	139%
Percent Recommended Daily Allowance contributed by 1 lb. bread	56% -	222% -	61% -	100%
Percent Recommended Daily Allowance contributed by 1 slice bread	3% -	14% -	4% -	6%
Percent Recommended Daily Allowance contributed by 6 slices bread	21% -	83% -	23% -	37%
Food and Drug Administration, Minimum Daily Requirements, Adult (e)	----- 1 mg -------			
Percent Minimum Daily Requirement contributed by 1 lb. flour	166% -	250%	200% -	250%
Percent Minimum Daily Requirement contributed by 1 lb. bread	100% -	400%	110% -	180%
Percent Minimum Daily Requirement contributed by 1 slice bread	6% -	25%	7% -	11%
Percent Minimum Daily Requirement contributed by 6 slices bread	38% -	150%	41% -	67%

	CALCIUM			
	1941		1943	
Amount in 1 lb. flour (a)	500. mg -	2000. mg	500. mg -	625 mg
Amount in 1 lb. bread (b)	333. mg -	1333. mg	300. mg -	800 mg
Amount in 1 slice (1 oz.) bread	20.81 mg -	83.31 mg	18.75 mg -	50 mg
Amount in 6 slices (6 ozs.) bread	124.86 mg -	499.86 mg	112.5 mg -	300 mg
N.R.C., Recommended Daily Allowances, Man (70 Kg.) Mod. Active--3000 cal. (d)	------800 mg -------			
Percent Recommended Daily Allowance contributed by 1 lb. flour	63% -	250%	63% -	78%
Percent Recommended Daily Allowance contributed by 1 lb. bread	42% -	167%	38% -	100%
Percent Recommended Daily Allowance contributed by 1 slice bread	3% -	10%	2% -	6%
Percent Recommended Daily Allowance contributed by 6 slices bread	16% -	62%	14% -	38%
Food and Drug Administration, Minimum Daily Requirement, Adult (e)	------750 mg -------			
Percent Minimum Daily Requirement contributed by 1 lb. flour	67% -	267%	67% -	83%
Percent Minimum Daily Requirement contributed by 1 lb. bread	44% -	178%	40% -	107%
Percent Minimum Daily Requirement contributed by 1 slice bread	3% -	11%	3% -	7%
Percent Minimum Daily Requirement contributed by 6 slices bread	17% -	67%	15% -	40%

(a) Flour Standards: Federal Register, May 27, 1941, page 2580; Federal Register, July 3, 1943, page 9116
(b) Bread Standards: Federal Register, June 7, 1941, page 2772; Federal Register, Aug. 3, 1943, page 10787
(c) Postponement of Required Riboflavin: Fed. Register, Dec. 3, 1941, p6176; Fed. Register, March 19, 1943, p3358

REQUIRED NUTRIENTS

NIACIN 1941	NIACIN 1943	IRON 1941	IRON 1943	(c) RIBOFLAVIN 1941 (postponed)	RIBOFLAVIN 1943 (Required)
6. mg - 24 mg	16. mg - 20. mg	6. mg - 24 mg	13. mg - 16.5 mg	1.2 mg - 1.8 mg	1.2 mg - 1.5 mg
4. mg - 16 mg	10. mg - 15. mg	4. mg - 16 mg	8. mg - 12.5 mg	0.8 mg - 3.2 mg	0.7 mg - 1.6 mg
0.25 mg - 1 mg	0.63 mg - 0.94 mg	0.25 mg - 1 mg	0.5 mg - 0.78 mg	0.05 mg - 0.2 mg	0.04 mg - 0.1 mg
1.5 mg - 6 mg	3.75 mg - 5.63 mg	1.5 mg - 6 mg	3. mg - 4.68 mg	0.3 mg - 1.2 mg	0.26 mg - 0.6 mg
----- 18 mg -------		----- 12 mg --------		----- 2.7 mg -------	
33% - 133%	89% - 111%	50% - 200%	108% - 137%	44% - 67%	44% - 56%
22% - 89%	56% - 83%	33% - 133%	66% - 104% -	30% - 119%	26% - 59%
1% - 6%	4% - 5%	2% - 8%	4% - 7%	2% - 7%	1% - 4%
8% - 33%	21% - 31%	13% - 50%	25% - 39%	11% - 44%	10% - 22%
----- 10 mg (f) ---		----- 10 mg --------		----- 2 mg ---------	
60% - 240%	160% - 200%	60% - 240%	130% - 165%	60% - 90%	60% - 75%
40% - 160%	100% - 150%	40% - 160%	80% - 125%	40% - 160%	35% - 80%
3% - 10%	6% - 9%	3% - 10%	5% - 8%	3% - 10%	2% - 5%
15% - 60%	38% - 56%	15% - 60%	30% - 47%	15% - 60%	13% - 30%

OPTIONAL NUTRIENTS

VITAMIN D 1941	VITAMIN D 1943
250 USP - 1000 USP	250. USP - 1000. USP
160 USP - 640 USP	150. USP - 750. USP
10 USP - 40 USP	9.38 USP - 46.88 USP
60 USP - 240 USP	56.25 USP - 281.25 USP
----- 400 USP (g) -----	
63% - 250%	63% - 250%
40% - 160%	38% - 188%
3% - 10%	2% - 12%
15% - 60%	14% - 70%
----- 400 USP ---------	
63% - 250%	63% - 250%
40% - 160%	38% - 188%
3% - 10%	2% - 12%
15% - 60%	14% - 70%

WHEAT GERM

1941 and 1943

Flour Standards for: Federal Registers, 1941 and 1943 (a): "it may contain not more than 5 percent by weight of wheat germ or partly defatted wheat germ;"

Bread Standards for: Federal Registers, 1941 and 1943 (b): "Each such food may also contain as an optional ingredient wheat germ or partly defatted wheat germ; but in no case is the total quantity thereof more than the maximum which may be present as a result of the use of enriched flour;"

(d) Recommended Daily Allowances: National Research Council's Circular, Number 115, January 1943, page 2
(e) Minimum Daily Requirements ~~authorized by Food and Drug Adm.: Federal~~ Register, November 22, 1941, page 5925
(f) & (g) N.R.C.: Niacin--10 mg Req. tentatively set; Vit. D--400 ~~(USP) Allowance~~ assumed, Circ. 115, 1943, p3,f'n.

*COMPARISON OF VARIOUS BREADS by Nora Kefauver, FDA, Nov. 1943		WHITE (a)(h)	WHITE ENRICHED (d)	WHITE WITH MILK-3.7% (c)(h)	WHITE RAISIN (a)(h)
Calories	(1 pound	1184	1184	1185	1325
	**(1 ounce	74	74	74	83
	(6 ounces	444	444	444	497
Protein	(1 pound	41.73 gm	41.73 gm	38.60 gm	29.93 gm
	**(1 ounce	2.61 gm	2.61 gm	2.41 gm	1.87 gm
	(6 ounces	15.65 gm	15.65 gm	14.48 gm	11.22 gm
Fat	(1 pound	5.90 gm	5.90 gm	9.10 gm	30.84 gm
	**(1 ounce	0.37 gm	0.37 gm	0.57 gm	1.93 gm
	(6 ounces	2.21 gm	2.21 gm	3.41 gm	11.57 gm
Carbohydrate	(1 pound	240.86 gm	240.86 gm	237.20 gm	231.79 gm
	**(1 ounce	15.05 gm	15.05 gm	14.83 gm	14.49 gm
	(6 ounces	90.32 gm	90.32 gm	88.95 gm	86.92 gm
Calcium	(1 pound	0.23 gm	****0.30 gm	0.32 gm	0.24 gm
	**(1 ounce	0.01 gm	****0.02 gm	0.02 gm	0.02 gm
	(6 ounces	0.09 gm	****0.11 gm	0.12 gm	0.09 gm
Phosphorus	(1 pound	0.44 gm	0.44 gm	0.44 gm	0.40 gm
	**(1 ounce	0.03 gm	0.03 gm	0.03 gm	0.03 gm
	(6 ounces	0.17 gm	0.17 gm	0.17 gm	0.15 gm
***Iron	(1 pound	3.63 mg	8.00 mg	3.86 mg	3.63 mg
	**(1 ounce	0.23 mg	0.50 mg	0.24 mg	0.23 mg
	(6 ounces	1.36 mg	3.00 mg	1.45 mg	1.36 mg
***Thiamin	(1 pound	0.25 mg	1.10 mg	0.27 mg	0.36 mg
	**(1 ounce	0.02 mg	0.07 mg	0.02 mg	0.02 mg
	(6 ounces	0.09 mg	0.41 mg	0.10 mg	0.14 mg
***Riboflavin	(1 pound	0.18 mg	0.70 mg	0.47 mg	0.20 mg
	**(1 ounce	0.01 mg	0.04 mg	0.03 mg	0.01 mg
	(6 ounces	0.07 mg	0.26 mg	0.18 mg	0.08 mg
***Niacin	(1 pound		10.00 mg	3.00 mg	
	**(1 ounce		0.63 mg	0.19 mg	
	(6 ounces		3.75 mg	1.13 mg	
***Vitamin D	(1 pound		****150.00 USP		
	**(1 ounce		**** 9.38 USP		
	(6 ounces		**** 56.25 USP		
Vitamin A	(1 pound				
	**(1 ounce				
	(6 ounces				

*Blank spaces indicate that information was not given in the respective source.

**Approximate Equivalents: 1 pound equals a 16-slice loaf of bread, 24 biscuit, 8 slices of Boston brown bread, 4 pones of corn bread, or 40 crackers; 1 ounce equals 1 slice of bread, 1½ biscuit, ½ slice of Boston brown bread, ¼ pone of corn bread, or 2½ crackers; 6 ounces equal 6 slices of bread, 9 biscuit, 3 slices of Boston brown bread, 1½ pone of corn bread, or 15 crackers.

***A range of figures was given in some instances, but only the minimums are recorded.

****Optional Ingredients.

(a) Sherman, Henry C., Essentials of Nutrition, MacMillan, New York, 1943, pages 370-384. In the calculation of pound values, tables were multiplied by factor 4.536.

WHOLE WHEAT (a)	WHOLE WHEAT-50% (e)(h)	WHOLE WHEAT WITH Milk-3.7% (c)	WHOLE WHEAT RAISIN (a)	RYE (a)	RYE WITH MILK-3.7% (c)
1111	1188	1184	1220	1152	1145
69	74	74	76	72	72
417	446	444	458	432	429
43.99 gm	38.96 gm	40.80 gm	33.11 gm	40.82 gm	40.40 gm
2.75 gm	2.44 gm	2.55 gm	2.07 gm	2.55 gm	2.53 gm
16.49 gm	14.61 gm	15.30 gm	12.42 gm	15.31 gm	15.15 gm
4.08 gm	4.99 gm	13.60 gm	14.06 gm	2.72 gm	9.10 gm
0.26 gm	0.31 gm	0.85 gm	0.88 gm	0.17 gm	0.57 gm
1.53 gm	1.87 gm	5.10 gm	5.27 gm	1.02 gm	3.41 gm
225.43 gm	233.15 gm	224.10 gm	241.32 gm	241.32 gm	225.40 gm
14.09 gm	14.57 gm	14.00 gm	15.08 gm	15.08 gm	14.09 gm
84.54 gm	87.43 gm	84.04 gm	90.50 gm	90.50 gm	84.53 gm
0.23 gm	0.17 gm	0.42 gm	0.25 gm	0.11 gm	0.19 gm
0.01 gm	0.01 gm	0.03 gm	0.02 gm	0.01 gm	0.01 gm
0.09 gm	0.06 gm	0.16 gm	0.09 gm	0.04 gm	0.07 gm
0.68 gm	0.71 gm	1.15 gm	0.70 gm	0.67 gm	0.67 gm
0.04 gm	0.04 gm	0.07 gm	0.04 gm	0.04 gm	0.04 gm
0.26 gm	0.27 gm	0.43 gm	0.26 gm	0.25 gm	0.25 gm
9.00 mg	7.07 mg	12.00 mg	8.67 mg	7.26 mg	7.26 mg
0.56 mg	0.44 mg	0.75 mg	0.54 mg	0.45 mg	0.45 mg
3.38 mg	2.65 mg	4.50 mg	3.25 mg	2.72 mg	2.72 mg
1.08 mg	0.84 mg	1.69 mg	1.69 mg	0.63 mg	0.61 mg
0.07 mg	0.05 mg				0.04 mg
0.41 mg	0.32 mg	0.56 mg	0.51 mg	0.15 mg	0.23 mg
0.45 mg	0.37 mg	0.57 mg	0.45 mg		0.14 mg
0.03 mg	0.02 mg	0.04 mg	0.03 mg		0.01 mg
0.17 mg	0.14 mg	0.21 mg	0.17 mg		0.05 mg
		14.00 mg			3.00 mg
		0.88 mg			0.19 mg
		5.25 mg			1.13 mg
			396.00 IU (USP)		
			25.00 IU (USP)		
			148.50 IU (USP)		

(b) Taylor, Clara M., Food Values in Shares and Weights, MacMillan, New York, 1942, pages 60-61. Values were calculated by enlarging given weights to the 100 gm. level, using various factors, and by then transposing into pound values as in footnote (a).

(c) USDA, Bureau of Home Economics, Nutritive Value of One Pound of Specified Food Materials (table D-6), continually being revised.

(d) Values for Calcium, Iron, Thiamin, Riboflavin, and Vitamin D are from Federal Register, August 3, 1943, page 10,787; values for Calories, Protein, Fat, Carbohydrate, and Phosphorus are from Sherman (see footnote (a)).

(e) Values for Calories, Protein, Calcium, Iron, Thiamin, and Riboflavin are from Taylor (see footnote (b)); the value for Phosphorus is from Rose, M. S., A Laboratory Handbook for Dietetics, MacMillan, New York, 1937, page 148; values for Fat and Carbohydrate were reckoned by adding $\frac{1}{2}$ of whole wheat bread figures to $\frac{1}{2}$ of white bread figures (see footnote (a)).

PUMPERNICKEL (b)(g)	BISCUIT, BAKING POWDER (a)(h)	BOSTON BROWN (a)(g)	CORN BREAD, WHITE MEAL (f)	CORN BREAD, YELLOW DEGERMINATED MEAL (f)	CRACKERS (c)(h)
1057	1683	1343	1210	1177	1885
66	105	84	76	74	118
396	631	504	454	441	707
30.21 gm	42.18 gm	27.22 gm	27.33 gm	24.93 gm	43.60 gm
1.89 gm	2.64 gm	1.70 gm	1.71 gm	1.56 gm	2.73 gm
11.33 gm	15.82 gm	10.21 gm	10.25 gm	9.35 gm	16.35 gm
	62.14 gm	28.58 gm	39.53 gm	32.00 gm	43.60 gm
	3.88 gm	1.79 gm	2.47 gm	2.00 gm	2.73 gm
	23.30 gm	10.72 gm	14.82 gm	16.00 gm	16.35 gm
	238.59 gm	244.94 gm	221.73 gm	234.00 gm	329.80 gm
	14.91 gm	15.31 gm	13.86 gm	14.63 gm	20.61 gm
	89.47 gm	91.85 gm	83.15 gm	87.75 gm	123.68 gm
0.08 gm	0.28 gm	0.59 gm	0.03 gm	0.03 gm	0.10 gm
0.01 gm	0.02 gm	0.04 gm	0.00 gm	0.00 gm	0.01 gm
0.03 gm	0.11 gm	0.22 gm	0.01 gm	0.01 gm	0.04 gm
	0.44 gm	0.84 gm	0.42 gm	0.42 gm	0.46 gm
	0.03 gm	0.05 gm	0.03 gm	0.03 gm	0.03 gm
	0.17 gm	0.32 gm	0.16 gm	0.16 gm	0.17 gm
6.80 mg	2.49 mg	13.60 mg	2.99 mg	2.99 mg	6.80 mg
0.43 mg	0.16 mg	0.85 mg	0.19 mg	0.19 mg	0.43 mg
2.55 mg	0.93 mg	5.10 mg	1.12 mg	1.12 mg	2.55 mg
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
0.06 mg	0.00 mg	0.04 mg	0.06 mg	0.02 mg	0.04 mg
0.33 mg	0.01 mg	0.21 mg	0.33 mg	0.09 mg	0.26 mg
0.27 mg	0.30 mg	0.32 mg	0.34 mg	0.23 mg	0.14 mg
0.02 mg	0.02 mg	0.02 mg	0.01 mg	0.01 mg	0.01 mg
0.10 mg	0.11 mg	0.12 mg	0.13	0.09 mg	0.05 mg
			1.80 mg	1.80 mg	2.27 mg
			0.11 mg	0.11 mg	0.14 mg
			0.68 mg	0.68 mg	0.85 mg
				333.32 IU (USP)	
				20.83 IU (USP)	
				124.00 IU (USP)	

(f) Values were computed from figures of corn meal in USDA table (see footnote (c)). Two-thirds of the figures recorded for corn meal were used since, according to Food Research Laboratories, New York, bread is 35% moisture (by weight). Also, one tablespoon (28.4 gms) of fat was allowed in the bread which boosts the Calorie and Fat figures of USDA table. Recipe for one pound of corn bread is: 2 cups of corn meal, 1 tablespoon of fat, salt, and water.

(g) Usual Ingredients: Pumpernickel--mixture of flours plus potato mash and other ingredients; Boston brown bread--equal portions of corn meal, whole rye flour, and whole wheat flour plus molasses and other ingredients.

(h) These breads were analyzed before the present legislation requiring enrichment of white flour and white bread was effective. Therefore, such breads today will have different values for iron, thiamin, riboflavin, niacin, and probably for calcium and vitamin D.